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[OFFICIAL NOTICE.]

American Gas Light Association.

OFFICE AMERICAN GAS LIGHT ASSOCIATION,
142 CHAMBERS STREET, NEW YORK.

To the Members of the Association:

The Ninth Annual Meeting will be held in the city of Boston, Massachusetts, on the 19th, 20th and 21st days of October next. Headquarters during the meeting will be at the Hotel Brunswick. The meeting will be called to order at 11 A.M., Wednesday, 19th of October, in the Hall of the Institute of Technology, opposite the hotel.

Members intending to prepare papers are requested to notify the Secretary of the subject selected, so that the order of business may be arranged so as to give all an equal opportunity of being heard. Committees appointed at last annual meeting are respectfully reminded that they will be called upon for reports.

As every effort is being made to render this meeting full of interest, the Secretary trusts that each member will feel that some share of the responsibility for the success of this effort rests upon himself, and contribute, therefore, from the experiences and matured results of the past year to the general information. No subject bearing upon the vast interest represented in the Association is too trivial, or unworthy of careful investigation and report. Data of observations, results obtained in experimental or practical workings, old facts seen in new lights, or theories of management, all form a valuable basis upon which to found discussions or write papers. The object of these gatherings being to advance the interests of a common calling, it is binding upon all to add to the stock of information any fact that will throw more light upon it.

During the meeting the Association will be the guest of the New England Association of Gas Engineers, and the Boston Gas Light Company. The local Committee of Arrangements has provided in a complete manner for the social entertainment of the members. A sail on the harbor, a drive through the beautiful suburbs of Boston, and a dinner being prominent features in their programme.

Members wishing to reserve rooms, and those intending to bring ladies with them, are requested to communicate with M. S. Greenough, Esq., Chairman of Committee.

Blank applications for membership can be obtained at this office, where arrears of dues can also be paid until Sept. 30th.

WM. HENRY WHITE,
Secretary.

GAS MAKING IN LONDON.

As much is being said now and then about the days of gas being numbered, that the light of the future will soon wipe out the feeble flicker of the faint and frequent gas jet, and that all that can reasonably be expected by shareholders is that they can enter the field of heating, and, after a time, develop a remunerative business, it may not be amiss to look over the field and see what is the extent of this industry that is so soon to disappear like "the will-o'-the-wisp," at the approach of some one with a copper wire in his hand.

It is very unfortunate that there are to-day no reliable data from which the entire and absolute extent of the industry can be determined. Probably no other industry of equal magnitude exists without there being some general information somewhere as to the extent, the amount of money invested, the amount of product, and some idea of the return obtained.

It has seemed wise to a majority of those controlling gas affairs in years past to throw around the whole business a veil of mystery. This course has probably been the very worst that could have been adopted and has done more to excite prejudice, dissatisfaction and unfriendly opposition than anything that could have been done.

Happily, this spirit is rapidly dying out, and is only seldom to be met with at the present day. In England full returns are published each half year by most of the companies; and, taking the city of London alone, perhaps some idea may be formed of the importance of this gas industry.

There is in London what is known as the Metropolitan District, and, besides this, a large outlying suburban territory which is constantly to be en-

croached upon by the city extensions until, at no distant day, what is now suburban will become metropolitan, and the ever-extending and pushing-forward crowds of seekers for homes in the suburbs will take possession of new fields which, in turn, may in time be added to the Great Metropolis of the English-speaking world.

What is known as the Metropolitan district of London is now supplied by four great companies, viz., The Gas Light and Coke Company and the Commercial Company on the north side of the river; the London Company, on both sides, and the South Metropolitan entirely on the south side. These are all that remain of the vast number which once existed there. We say vast because, at one time, in this same area, or even a smaller one than the present metropolitan district, there existed no less than *thirteen* companies whose mains and services were crossing and recrossing each other until the confusion became so great that it was, at some points, difficult, for any one company to distinguish its property from that of its neighbor.

A wise and far-seeing policy led the Old Chartered Company, now known as The Gas Light and Coke Company, years ago to begin the gradual amalgamation of the companies on the north side of the Thames. This policy has been steadily followed until to-day the Commercial, and a portion of the district of the London company, are all that remain outside of the jurisdiction of The Gas Light and Coke Company. The Commercial will probably remain for some time to come independent; but negotiations have recently been going on to amalgamate the interests of the London Company with The Gas Light and Coke Company.

While the manufacture of the London Company is conducted on the south side of the river, and a large district is also supplied on that side, still they have two isolated districts on the north side of the river which are completely surrounded by The Gas Light and Coke Company. Should negotiations succeed between these two companies, it would seem altogether probable that the portion of the London district on the south side of the river would eventually be transferred to the South Metropolitan Company, which is now the only other company existing on the south side of the Thames in the Metropolitan district.

Having explained these relations of territory of the four companies now existing, let us look at the business they are doing, the amount of material they use, the prices charged for gas, and the profits made by these undertakings, and some idea may be formed of the probability of its disappearing at once.

The amount of capital which the four companies above named are authorized by law to raise, both by shares and loans, amounts in round numbers to 80 millions of dollars. Of this amount, at the end of last year, over 65 *millions had been actually raised and employed* in the business, being $34.31 per ton of coal carbonized, and $3.60 per thousand feet of gas sold during last year.

The amount of coal required for the business, and actually used during last year, is something of an item, being no less than 1,898,474 tons, of which about six and a-half per cent. was cannel. Of this amount The Gas Light and Coke Company used nearly two-thirds, viz., 1,206,217 tons. The average price paid per ton of coal was $3.65, or 36.86 cents per thousand feet of gas sold, which amounts, in the aggregate, to very nearly seven millions of dollars per annum paid for coal.

The amount of gas made was 19,402,389,000 cubic feet, or 10,220 cubic feet per ton of coal, and of this amount there was sold 18,091,263,000 cubic feet, or 9,529 feet per ton of coal, and there was used at works, etc., of the companies, 227,157,000 cubic feet, which makes the unaccounted-for-gas about 5.6 per cent.

The next in value of the products of this manufacture is the coke, which amounted to 2,330,488 chaldrons, or an average of 44 bushels per ton of coal (by the new weights and measures Act of 1878.) Of this amount, 601,772 bushels were used in manufacture, or an average of 26 per cent. of the coke made.

The coke sold brought, on the average, $1.10 per ton of coal carbonized, or 11.16 cents per thousand feet of gas sold.

Of the other residuals the price obtained for tar was 68¼ cents per ton of coal, or 7.18 cents per thousand, and for ammonia and its products 54 cents per ton, or 5.72 per thousand—making the total returns for residuals $2.38 per ton of coal, or 24 cents per thousand; from which it will be seen that nearly two-thirds of the first cost of coal was returned to the companies from the sale of residuals (in the South Metropolitan Company this return amounted to 68.47 per cent.), leaving the net cost of coals at $1.27 per ton.

The manufacturing charges, per thousand feet of gas sold, were as follows: Purification, 1.82 cents; salaries at works, .82 cents; carbonizing wages, 7.16 cents; wear and tear, 9.86 cents—total, 19.66 cents.

Distribution, including salaries and wear and tear, was 4.4 cents; rent and taxes, 2.76 cents.

Under the head of "Management" the expenses were as follows: Directors and auditors, .46 cents; salaries, .56 cents; collectors, 1.06 cents; stationery and general charges, .52 cents, making a total for management of 2.6 cents. Then for other charges, such as law expenses, bad debts (.52 cts.), etc., etc., the expense was 1.38 cents—so that the total working expenses amount to 30.8 cents per thousand feet of gas sold, which, added to the cost of coals, less residuals, makes the cost for coal and expenses 43.6 cents.

The net price received for gas was 78.76 cents, which would give as the gross profit on the gas 35.16 cents. But there are various other items to be considered on both debit and credit side, such as meter repairs, exceptional charges for Parliamentary expenses on the one hand, and meter rents and petty miscellaneous receipts on the other, together with insurance funds and interest on borrowed monies, which reduce this amount to 30.14 cents which was the net profit per thousand feet of gas sold, and of this amount 28.06 cents were paid in dividends, and 2.08 cents held as surplus. The net profit of the years' business amounted to 10.35 per cent. on the stock and share capital employed.

We have given these figures, taken from official sources, as published and compiled by Mr. John Field, of London, somewhat in detail that there might be no misunderstanding of the accounts; and also that the fact may be made to appear that the returns made upon the capital invested are not excessive. We do not believe that there is any branch of manufacture in the United States that would consider that they were doing any very wonderfully profitable business if their profits at the end of the year did not exceed ten and a-half per cent. on the money employed. It is true that London is a large city, and possesses many advantages which smaller places have not; but the gas supply of different localities is generally in something like a proportion to the population, and from the figures given above some idea may be formed of the magnitude of the gas interest, and the probability of its disappearing in a night. So far from there being any falling-off the increase is steady and constant in spite of all the other means of illumination which are constantly being devised and presented to the public attention.

The *increase* in the amount of gas sold, during the first half of this year, by the Chartered Company, in London, amounts to nearly 300 millions of feet which, though it is only an increase of about six per cent. over the amount for the corresponding time last year, does not appear exactly like an evidence of decay. *Gas property, well-managed*, was never stronger than it is to-day.

A New Method of Preparing Sulphate of Ammonia from Gas Liquor.

At the late meeting of the Société Technique du Gaz en France, M. Marche presented to the notice of the members of that body a description of a process for the manufacture of sulphate of ammonia. One of the most important features of the new method is that it may be generally applied in small works.

The process consists in the employment of crude sulphate of alumina, or alum cake, instead of sulphuric acid, as the re-agent. This material costs about 2s.6d. per cwt. in the centers of production, and the authors of this process claim that, in consequence of the high tariff imposed upon acids conveyed by rail, sulphuric acid would be less costly in the form of sulphate of alumina than in that of chamber or concentrated acid. The apparatus employed consists of—

1. A wooden vat which is filled with liquor, to which the re-agent is added in the proportion of 4.5 kilos. per degree per hectolitre, and after standing from 10 to 12 hours the liquor is converted into sulphate of ammonia.

2. An evaporating pan of sheet iron, in which the concentration of the liquor is effected by means of the waste heat from the ovens.

3. A small cask in which lixiviation is effected—the mother liquor returning into the pan and mingling with the liquor of other operations. The reaction is as follows:

The liquor contains sesqui-carbonate of ammonia, and, in feebler proportion, hydro-sulphate of ammonia. On coming in contact with the sulphate of alumina, the two salts are brought into the state of sulphate of ammonia, which remains in solution in the liquor. A precipitation of hydrate of alumina takes place, which completely purifies the liquor, while the carbonic and hydro-sulphuric acids are liberated. The alumina is precipitated completely in twelve hours, and increases so rapidly in density that it may be taken out with a shovel when the cask is half-empty. Therefore it is sufficient to remove, every three days, the excess of dense precipitate, which contains but little sulphate of ammonia—not more than two per cent. in fact.

The reaction is complete. The advantages of the process are that the expense of fitting up the appliances is extremely trifling; there is no expense for fuel, no supervision is needed, there is no wear and tear of plant, nor is any manipulation of the acid required, while the weakest liquors are utilized. The process is applicable to the smallest works, and also to those of the farthest removed from the works where the acid is produced, and with it there is the possibility of obtaining sulphate from the first distillation owing to the purification effected by the re-agent. With the same apparatus may be produced chloride of ammonium containing 30 per cent. of ammonia.

The Economical Use of Gas Furnaces.

The London *Journal of Gas Lighting* of July 26 contains the following on this subject:

At the recent congress of the Société Technique de l'Industrie du Gas en France M. Lencauchez presented a memoir on the use of gas generators for retort furnaces, in which some important conclusions with reference to this question are arrived at. The author begins by remarking that the system of gaseous firing is no novelty, and that the composition of the gaseous fuel itself, as produced in a generator, is so generally known that he has not thought it necessary to describe it in detail. But one important point upon which he desires to call the attention of his colleagues in gas management is this: According to Regnault and other authorities, when carbon is transformed into the gas carbonic oxide, if this gas is brought down to 0° C. under pressure, it does not contain more than 77 per cent. of the heating power of the carbon at the expense of which it is formed. But in practice there is a difference, for coke is not pure carbon, and in the generator the conversion of solid fuel into gas for the furnace is far from yielding a combustible gas free from watery vapor and carbonic acid; hence generator gas does not contain more than 67 per cent. of the heating power of the coke from which it is made. It may be objected that this is of small importance, since in the Siemens system, with a syphon, the gas reaches the furnaces with a temperature of at least 350° C. (662° F.), and that in the Siemens-Arson system (without syphon), or those of Boëtius, Liegel, Muller, Ponsard, Radot, etc., the gas is at least 900° C. (1650° F.), and even 1100° C. (2010° F.) in the systems of Boëtius and Liegel. It may be objected, that is to say, that the loss of 100 — 67 = 33 per cent. does not exist, since a notable proportion of the sensible heat disengaged in the generator reaches the fire. In the syphon system of Siemens the loss of 33 per cent is reduced to about 21 per cent., when the gas is at 350° C. (662° F.); in the systems of Ponsard and Radot the loss is only 10 per cent. with gas at 900° C. (1650° F.), and in the systems of Boëtius and Liegel the loss is not more than 4 per cent. with gas at above 1100° C. (2010° F.)

It should be observed that for the principle of regeneration to be complete, the gas and air should arrive at the furnace at 0° C., for if we have a weight of 100 kilos. of smoke to cool down from 1200° C. to 200° C., an equal weight of gas and air would be raised from 0° C. to 1000° C. if the exchange of heat in the regenerative apparatus were perfect. In practice, with coke, of 100 cubic meters of air passing through a furnace, 40 cubic meters, or two-fifths, go through the generator, and 60 cubic meters, or three-fifths, pass through the regenerator, if there is one, or go direct to the furnace to burn the gas if there is no regeneration; therefore, if the gas is already at 900° or 1000° C. upon its arrival at the point of combustion, the regenerator has no effect upon it, and as in the form of gas there is air combined with carbon, hydrogen, watery vapor, etc., it amounts together to more than 46 per cent. of the total weight. Hence there is 46 per cent. of the total weight which is at the same temperature as the regenerator, and consequently cannot derive any benefit therefrom. This is the case in the Arson-Siemens arrangement.

It may now be determined what fraction of the total heating power may be made available by the process of regeneration. In the usual construction of settings of seven retorts placed back to back, it may be assumed—

1. That at the fire-bars the temperature is about 1600° C. (2910° F.)
2. That at the outlet of the setting, or the entrance into the main flue, the lowest temperature of the gases is 1200° C. (2190° F.)
3. That for a good chimney draught it is not necessary that the smoke gases should be higher than 200° C. (390° F.)

These rules being admitted for the average conditions of larger settings of seven retorts placed back to back with six charges in 24 hours, it can be shown that the heat developed in the furnace is thus divided:

Heat utilized	(*a*)—Taken up by the coal in process of carbonization	3 to 4	
Heat dispersed	(*b*)—Wasted by means of the grate and furnace doors	6	
Do.	(*c*)—Heat conducted and radiated from the setting	15	
		—	21
Heat lost	(*d*)—Carried off by the furnace gases leaving the furnace at 1200° C., when they should not be more than 200° C.	62	
Heat utilized	(*e*)—Carried away by the chimney, but useful for creating a good draught	13	
	Total	99 to 100	

So that it is easy to see that the utilization of heat is almost *nil*, being 3 or 4 per cent. at the outside, and often difficult to determine; in fact, when a furnace loses the use of one or two retorts, the consumption of coke remains unaffected. In a setting of eight retorts the loss of two of them means a diminution of one-fourth in the productive power, but the saving in fuel is not proportionate. It is not probable that much improvement in this respect can be looked for. If the furnace is heated by gas, the loss of 6 per cent., shown above to be due to radiation from the grate and fire door, disappears, giving place to that due to radiation from the generator.

Saving Heat by Thick Walls.—In section *c* of the above statement M. Lencauchez values the loss due to radiation from the setting itself at 15 per cent. If the walls are thickened to obstruct the passage of heat even to the small extent of 4 per cent. on the portions *a*, *b*, and *c*—that is, 4 + 6 + 15 = 25 per cent. of the total heating power; this saving of 4 per cent. realized between 1600° C. and 1200° C., within which limits lies the working heat, appears in practice as an economy of 16 per cent.

This has been proved by the experience of M. Le Treust, of the Vaugirard works of the Paris Gas Company. For a further example of saving by thick furnace walls, the example of iron puddling furnaces may be cited, wherein from 1100 kilos. to 650 kilos. of coal of like quality is used to produce the same weight of iron, the great difference being due to the fact that some parts of the walls of the latter class of furnaces are double and treble as thick as the others.

Further, it is well known that in gas making an isolated retort set over a furnace by itself does not produce sufficient coke to serve itself; that is, it consumes 75 kilos. of coke to carbonize 100 kilos. of coal, while settings of seven retorts placed back to back do not exceed a consumption of 25 kilos. of coke in doing the same work. It is thus shown that large furnaces effect an economy of 50 to 66 per cent. in comparison with small ones. How this result is achieved may be thus indicated. The area of all the exposed walls of a setting of one retort being taken as unity, the exposed surface of a double setting of 7 retorts is about 4; but as this surface liable to cause loss of heat is only four times larger than the other, while it contains 14 times more retorts, it appears that the loss per retort-unit will be about 3 times less. This consideration explains how large settings of 9, 11, or more retorts are so much more economical as they are larger; therefore it is not right to compare a setting of 9 retorts to other settings of 5, 6, or 7 retorts, and to ascribe to gas heating in the former case all the observed economies, which are really, to some extent, due to the increased size of the apparatus.

Again, if a furnace is built with thick walls of hollow refractory bricks, the saving of 16 per cent. realized by M. Le Treust will be surpassed. In the outer walls the hollow brick, which is very impervious to heat, may be placed between an inner lining of extra refractory bricks and an outer casing of red brick. The hollow bricks may be replaced by common fire-bricks made extremely porous by being burnt with an admixture of coke or charcoal dust with the clay of which they are made. The combustible dust burns out, and a light, refractory, and porous brick remains, which is a bad conductor of heat. Thus by following M. Le Treust an economy of 20 per cent. may be secured, by carefully working porous or hollow bricks in the walls wherever loss of heat might be expected.

Economy Due to Regeneration.—In section *d* it is shown that the lost heat amounts to 62 per cent., which might be recovered if the burnt gases could be cooled down to 200° C, and if the gas from the generators arrives at the furnace at the temperature of the air. But as the material structure of the regenerator, like the furnaces, loses heat by radiation, it follows that in spite of very thick walls this loss cannot be less than 8 per cent., to which must be added the losses due to the escapes of hot air and gas into the smoke flues, which amount to at least 5 per cent.; therefore of the 62 per cent. mentioned in *d*, at least 13 per cent. is irrecoverable, and 49 per cent. of the total heat remains for disposal.

Here it should be remarked that these economies have never been fully realized in practice. In the Siemens arrangement there is a loss of 33 per cent., as stated at the commencement of this article. Then the apparent industrial economy is reduced to 49 — 33 = 16 per cent., which the Siemens syphon has very rarely obtained, when the savings due to the increased size of the furnaces and the application of non-conducting coatings have been taken into consideration. But if the gas is at 1200° C. when it arives at the furnace, as with the arrangements of Boëtius and Liegel, it completely escapes regeneration, and as the gas represents 46 per cent. of the weight of the combustible, it follows that regeneration, if practiced with a true recuperator on air alone, becomes reduced to 49 × (1.00 — 0.46) = 26 per cent.; whereupon the smoke will escape at a temperature of 600° C. (1110° F.), so that metallic dampers and valves cannot be used. This is the case in the Siemens arrangement without syphons, the accumulators or regenerators for the gas being utterly useless; but as in the Boëtius and Liegel systems the principle of recuperation, imitated by a few large chambers, scarcely heats the air to 180° or 220° C. (360° to 400° F.), the useful effect of the regeneration is practically *nil;* the smoke issues from the chimney at a bright red heat—a fact which renders comment superfluous.

Practically it cannot be proved that a saving of more than 26 per cent. attaches to generator firing, which is in the Siemens arrangement reduced by 10 per cent. lost by radiation from the grate, which leaves the apparent industrial economy at just 16 per cent. In the Boëtius system the loss of heat by the fire grate is scarcely 6 or 7 per cent.; but as the air is barely heated to 200° C., the recuperation of heat, instead of being 26 per cent., is not much more than 3 or 4 per cent. The apparent saving from the use of this system is more due to the additional number of retorts used in a setting. It should be stated that the Siemens arrangement possesses the same advantage of size and number of retorts.

If we now pass on to consider what goes on in a Liegel furnace, says M. Lencauchez, we shall notice that as the generator only has a slit for the admission of air, which opening is 10 by 70 centimeters oblong, the radiation is yet smaller in amount than with the Boëtius, and the economy consequent on the use of gas for heating instead of being *nil*, rises to 3 or 4 per cent., but the *apparent* economy is still more considerable, for the Liegel furnaces having 9 retorts give the proportion 7 : 2 : : 100 : 28, which makes the apparent saving amount to 28 and 30 per cent., to which the actual use of gaseous fuel and regeneration do not contribute a real useful effect of more than 3 or 4 per cent. The proof relied upon by M. Lencauchez for these statements referring to the systems of Boëtius, Liegel, and their followers, is simply that the temperature of the gases and smoke is with them the same in the chimney as with the old grate furnaces. This proves that if the combustion is better and the distribution of heat more perfect, the value of the regeneration is not sensible, as at least 49 or 50 per cent. of the heat rendered disposable by the furnace finds its way into the chimney and is lost.

From what M. Lencauchez has laid down in this paper, it appears that in the system of Siemens, with the syphon, as in iron works furnaces, 33 per cent of the heating power is lost before the gas arrives at the furnace, and although the regenerative appliances used with this system are as complete as possible, they are unable to gather up this loss of power. Equally in the systems of Siemens-Arson, Ponsard, Muller, and Fichet, with well developed recuperators heating the air to 1000° C., or even to 1200° C., before combustion, there is only 26 per cent. of the heating power contained in the spent gases which can be recovered; therefore the loss on the disposable 62 per cent. is 62 — 26 = 36 per cent. But as in these arrangements there is no sensible loss of gas, the practical results are about equal to those obtained by the use of the Siemens syphon system. Besides, any continuous apparatus, working always in one direction without changing the current by means of valves, is more favored at the present time than the original arrangement of Siemens, which requires not less than four valves in each furnace to be changed every hour, or at most two hours. Alone, to the present time, the Paris Gas Company has remained faithful to the Siemens furnaces, and these are still constructed at the various works of this Company, with various improvements that have been suggested by practice.

As it is practically impossible to state everything that goes on in the working of furnaces, and M. Lencauchez naturally declines to bring forward a number of observations bearing on particular cases, he gives a list of properties and peculiarities which any furnace may possess; that is to say, a furnace may (1) lose more or less heat by the fire-bars and door of its furnace or generator; (2) have a good or bad combustion (digestion?) for coke or gas; (3) possess a greater or less thickness of walls; (4) give a more or less perfect distribution of flame and heat; (5) accommodate a greater or less number of retorts of various sizes; (6) if on the Siemens system, be with or without a syphon; (7) possess a good or bad regenerator, with a heating surface more or less large, etc. Then the figures given in the earlier part of this paper, under the classes *a*, *b*, *c*, *d*, and *e*, are to be considered fair averages.

M. Lencauchez considers that the term "gas furnaces" should not be applied to the systems of Liegel, Boëtius, and their derivatives, as they are nothing more than improved grate furnaces without really useful regeneration.

The author gives the following opinions regarding the best way of obtaining good results from gas firing as applied to retorts. It has been already shown that the regeneration of cold air and gas is alone capable of arresting the most considerable amount of waste heat from the spent gases; if, then, in order to cool the gas on its way to the furnace, or rather to the regenerator, it is made to superheat steam to 700° C., this will be mixed with air equally superheated, and will traverse the apparatus, decomposing to form water gas and carbonic oxide. The quantity of combustible gas would thus be augmented by the whole of the fraction of 33 per cent. now lost, which would be utilized. If only 20 per cent. of this 33 per cent. were employed the useful effect of regeneration would be increased from 49 or 50 per cent. to 70 per cent.

In the actual state of things this great and perfect utilization is no more possible than it was in 1872, when the author investigated it on behalf of the Paris Gas Company; the structural cost would be far too heavy. Meanwhile, the grates of gas generators may be kept watered, and the doors kept closed by double casings. In this way M. Lencauchez has succeeded in bringing down the temperature of the gas on leaving the generator from 1150° C. to 850° C., and in utilizing all the radiation of the grate, which gives an addition of 15 per cent. to the combustible gases. The heating power of the gas is sensibly the same as that of carbonic oxide, producing, therefore, an economy of 15 per cent., to which must be added 26 per cent., making a total of 41 or 40 per cent. This saving, it will be remarked, has nothing to do with any increase in the number of retorts, but merely with the utilization of the heat lost by the grate and carried away by the smoke.

In conclusion, M. Lencauchez enumerates the improvements which may be made in gas furnaces, but, in so doing, repeats his warning that all comparisons must be made between furnaces of equal size, and with the same number of retorts of similar capacity. This being understood, he indicates the savings that may be effected in the ordinary industrial working of a setting:

1. Saving due to the introduction of water by the generator grate, forming a mixture of H and CO	15 per cent.
2. Saving due to M. Le Treust's method of non-conducting construction	12 "
3. Saving due to perfect regeneration	30 "
Total of possible savings	57 per cent.

It therefore appears that by the use of gas heating for retorts a practical saving of 57 per cent. may possibly be realized with much care and forethought in constructing the apparatus.

Lastly, M. Lencauchez remarks once more that *regeneration* is necessary to good working with gaseous fuel. There are, of course, good and bad generators, and the regenerative system is only of use when good apparatus, making with the aid of water a gas rich in hydrogen, is employed. The author compares a system of good regenerative working to a first-class steam engine, steam jacketed, and fitted with every improved appliance, served by a good boiler. Steam jackets, etc., would be of no use with a wasteful boiler; and neither, according to M. Lencauchez, is a good regenerator unless coupled to a good furnace and retort setting, for the gross economy effected is nothing more than the accumulation of a number of petty savings.

Heating and Cooking by Gas.

George Anderson, Esq., furnishes the following sensible and timely letter to the *Review of Gas and Water Engineering* on this important subject:

There are innumerable instances where people would heat bedrooms, lobbies, and even sitting rooms, were the subject brought before them in a practical form and the gas cheap enough.

I don't refer to the metropolis or to large towns, for there, in thousands of instances, the practice is already largely adopted, and a large trade is already done, for stoves of all kinds can be readily seen, and gas is so cheap that nothing but old established habit prevents gas from being universally used instead of coal.

But I refer to provincial towns of lesser size, where gas is necessarily dearer, and where there is scant choice of the inhabitants seeing the gas-heating appliances so commonly to be seen in large towns.

There are many gas works where the works are only partly developed; the mains are but little used during the day; the same with the gasholders; so that it would only be the retorts, up to the purifiers, that would require to be of larger capacity, and that only after a very considerable extension of business had been obtained.

I read lately of a town where they sell as much gas for heating as they do for lighting; but if only 50 per cent. was used for heating it would make a vast difference in the profits of many a struggling company, even if they were to offer some inducements to the consumers.

In the case to which I have referred they sell the gas for heating at a lower price than that for lighting. This is already done in some places, and where it can be adopted it is well worth the consideration of gas companies.

Suppose a company sells 20 million feet of gas per annum at a price of 5s. per 1000, and that the cost price for materials and labor for the gas as delivered at the consumer's meter is 3s. 3d., leaving 1s. 9d., which I will divide into 1s. 6d. for interest on money invested, and 3d. for certain standing expenses, such as directors, and that would not be altered in any way.

Suppose that the gas company were to sell gas for heating at 4s., receiving only 9d. per 1000 feet for profit. Ten million at 9d. per 1000 would be £375.

I will assume the capital of the company to be £18,000; the profit at 1s. 6d. on 20 millions would be £1,500, or £50 more than a dividend at the rate of 8 per cent. If you add to this the profit on 10 million sold at s

profit of 9d., or £375, you obtain a total profit of £1,850, or £50 more than a dividend of 10 per cent.

It may be argued that every extension of business should increase *all* the charges, as everyone would have more to do. I grant the policy of this, but as a set-off against the argument I have not put down any profit on the sale of cooking and heating stoves.

Gas companies are the best parties to deal in such things in small towns. Their engineer knows more of the subject than any ironmonger can be expected to know. They have premises and appliances where practical tests can be shown to would-be purchasers.

The gas manager can have a gas stove in his own office and a cooking stove in his house.

The gas company could keep a small stock of articles most suitable to the neighborhood, and illustrations from the makers of larger and more costly articles less likely to be inquired for.

The manager's office is a kind of thoroughfare for hundreds of the inhabitants, who come on matters of business. His gas fire would thus be seen by the people—it would be an advertisement, and as gas fires can be made so like coal fires, barring the smoke and ashes, it would be well to tell by a label that "this is a gas fire," or many might go away without knowing it.

There is another objection, however. People have already grates in their rooms and ranges in their kitchens, and will not incur the cost of other appliances. Doubtless this is the case, and we do not expect everyone to change at once from coal to gas. I would rather they would not, for we could not attend to one per cent. of their wants. On the other hand, there are many people who would like to be able to boil a pot or roast a fowl in addition to what they can now conveniently do. This they could do with a small gas stove at a cost of 30s.

A kitchen range does not last, on an average, more than ten to fifteen years, and during that time there has frequently been "something wrong with the kitchen boiler;" and if people only knew that they work more economically by gas than by coal—no ashes or cinders to spoil the dripping, no spits or jacks required, no big fire that half roasts the cook by the time it wholly roasts the meat, and *more weight of meat brought to table*—they might think of giving the gas manager a call before they ordered a new range.

Then as to a gas fire for heating a room, a bit of gas pipe and a tap placed in the ordinary grate, and a few balls of asbestos thrown over it, turn on the tap, light the gas; and you have a blazing fire in five minutes, and you can increase or diminish the fire by merely turning the tap, without ringing for the servant or applying to a coal scuttle. When a chill evening in autumn comes on, the day has been wet, many a one would like a room aired; but they hesitate to remove the stove ornament, as to-morrow may be fine: so they sneeze and grumble at the horrible weather, and make themselves thoroughly uncomfortable, all for the want of being able to lift off the ornament, light the gas fire, and be jolly, replacing the ornament when they don't want the fire any longer, and "all things are serene" when the weather becomes so.

Moreover, there are many places where a little heat would sometimes be agreeable—where there is no fireplace nor any facile means of forming a smoke flue—which a gas stove and a bit of stove pipe, at a cost of 20s., would render comfortable.

Then, again, in summer time there is no fire required, unless in the kitchen, and in small households this is only wanted to boil water and cook a rasher or chop for breakfast; then there must be a fire to cook the dinner, and if there is anything to roast, the fire must be put in order an hour before you begin; and then in the evening there must be a fire for tea; so, in fact, the fire must be kept alight the whole day.

Now, with a gas fire, all that is wanted is to light the fire for breakfast twenty minutes, for dinner three-quarters of an hour to an hour and a half, according to requirement, and a quarter of an hour to twenty minutes for tea; and the house can be cool and comfortable for the rest of the day, with not one-fourth the trouble to the servant. Indeed, many a lady of moderate means could do all this herself without soiling her fingers, or she could give the servant a holiday oftener without being "put about" for want of her.

Some may deem these details too trifling, but there is nothing trifling that adds to comfort and saves expense. Franklin said, "take care of the pennies and the pounds will take care of themselves."

I have known a lady of limited means with a gas fire do much of her domestic work, which she would not have done with a coal fire; by the expense which she thus saved she could do other things for the comfort of herself and husband; and, especially in the beginning of life, industry and economy of this kind makes all the difference between happiness and misery in after life.

I write for the bread-earning millions, not for the idle few. We can purchase gas heating appliances, from a trivot that boils a quart of water in twenty minutes, at a cost of 2s. or 3s. for the trivot and a farthing for the gas, to a stove that will cook an entire dinner for six to ten persons at a cost of £4 to £8; and, in these latter, it might in many cases be well to offer consumers some inducement, such as letting by hire, as pianos and other household things are done. Why is it that individual tradesmen do this and gas companies do not? Because of the superior sharpness of the tradesman. There is something more elastic in individual than in associated action. Fancy the inconsistency of a tradesman who hires his goods sitting on a board of gas directors and voting against the proposition to hire gas stoves.

I therefore ask gas directors to think of this question. Suppose they were to hire gas stoves at 10 per cent. on the cost, being 5 per cent. for interest on capital, 2½ per cent. for depreciation, and 2½ per cent. as a bonus to their manager for the extra trouble he would have in pushing the trade and educating customers in the use of them.

To take an average case, suppose the gas appliances were £5; the customer would pay 10s. per annum, or 2s. 6d. per quarter. The company would get 7s. 6d. and the manager 2s. 6d.

Or the hiring and purchase system might be adopted at a higher annual payment, depending on the life of the hiring.

There are many details which each locality should work out for itself, depending on local circumstances; and I would add that the hiring system might be applied to lighting appliances also.

I should be glad if some of your readers who have had experience in this direction would give us some hints of their difficulties, as I propose to try it myself, and will be grateful for any information or light they can throw on the subject.

GEORGE ANDERSON.

35 Great George Street, Westminster.

[From the London "Journal of Gas Lighting."]

Gas Service Pipes.

Mr. W. Mackenzie, of Dunfermline, read the following paper on this subject at the Glasgow meeting of the North British Association of Gas Managers:

The subject of the brief communication which I have the honor to submit to the members of this Association is the unpretending, though not unimportant one of service pipes. The last, and I think the only occasion upon which we had a paper on this subject was at our Perth meeting in the year 1865, when I may say our Association was in its infancy. The contributor of that paper was our esteemed member Mr. Thomas Whimster, and I well remember the very interesting discussion which came out of it. There are few here to-day who were present on that occasion, and, unfortunately, no record of the discussion remains; for in those times we could not aspire to the luxury of having an official reporter to take note of our proceedings. Now, however, our transactions are fully and well reported, and duly published, and form a most valuable book of reference, and I am quite sure, that no member of this Association would consider his library complete without the annual report of our proceedings.

I cannot hope to do much more than repeat what has often been said on this subject, nor to bring before you methods other than those in daily practice among us; but if I succeed in eliciting from members a general expression of experience on this matter, I shall feel satisfied. The subject is one of primary importance, for if, as has been often said, the dividends are made in the retort house, they are too often reduced, or lost, through defective service pipes, the great source of leakage or unaccounted-for gas. Too great attention, therefore, cannot be given to the materials of which our service piping is composed, or to the method of laying the pipes.

As to the sizes of service pipes, I fear that many of us have erred in the past in this department of our operations, as well as in that of mains, by laying pipes of too small capacity. The experience of several severe winters has convinced me that anything less, even for requirements the most unimportant, than ¾-inch bore should never be laid, and I would not, in any circumstances, lay a greater length than 10 yards at a stretch of any one size, from 1 inch downward.

The depth at which service pipes are laid from the surface is also a very important matter, and one which has perhaps received too little attention. In all cases of new main laying I arrange for an average depth of cover for the main of at least 28 inches, and at this depth a good cover can generally be obtained for the services. As an instance of the necessity of laying pipes at a sufficient depth, I may state one of my experiences during the past winter. In an outlying district, during the prevalence of intense frost, the supply of gas became gradually less, and in a very short time was stopped altogether. The main is of 2-inch bore, with a declivity of 1 inch in 3 feet, the declivity being in the same direction as the gas. On exposing this main at its shallowest part, which was about 20 inches from

the surface, and drilling a ¼-inch hole in it, we found it completely closed up with ice.

The materials of which service pipes should be made may next claim our attention, and these may be taken to be of either lead or iron, cast or malleable. Many managers I know use lead exclusively, and it must be admitted that pipes made of this metal have several properties or qualities to recommend them. They are not liable, in general conditions, to corrode; they are easily handled and applied; and the smoothness of the surface causes the least amount of friction to the passage of the gas.

A number of years ago I tried lead experimentally on a limited scale, but in course of time I found that although each service had been carefully laid on a wooden board, more or less unsteadiness in the supply of gas manifested itself, caused by unequal subsidence from surface pressure. Frequently, too, I found them extremely apt to be damaged by sewage or water supply operations. This was all in one street, every service pipe in which I renewed with lead; but I have not again used it, because, with the drawbacks I have mentioned, I consider it is not so well adapted, nor so satisfactory in general use, and it is decidedly dearer than malleable iron tubing, which I now employ in all cases for small services. If the tubes are well made, and properly tested before being laid, and if due precautions be taken in the laying, I am satisfied that they are quite as durable, and will remain gas-tight at least as long as any others, and will give greater satisfaction under all circumstances to every one concerned.

I was much interested lately on reading some statistics relating to the growth and development of the manufacture of malleable iron tubes. When first manufactured early in this century, they were, of course, made by hand in 6-inch welding heats at a time, and in 3-feet lengths, and two or three of these lengths were again welded together. In the year 1828 a ¼-inch tube cost 6½d. net per foot; to-day the net cost of the same tube, but an infinitely superior article, is about 1¼d. per foot. At the time I have mentioned a good day's work of two men was about 65 to 75 feet of tubing; at the present time, by one firm alone in this city, there are turned out every day about 25,000 feet of tubing. At present, too, malleable iron tubes are made as large as 14 inches in diameter.

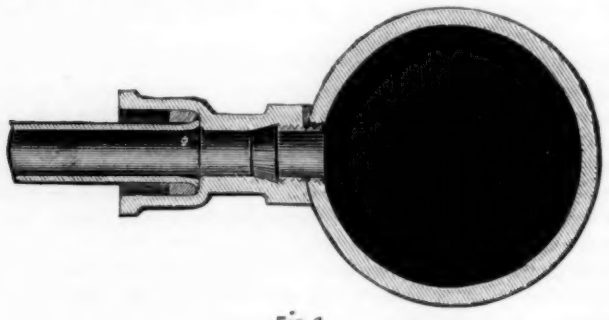

Fig 1.

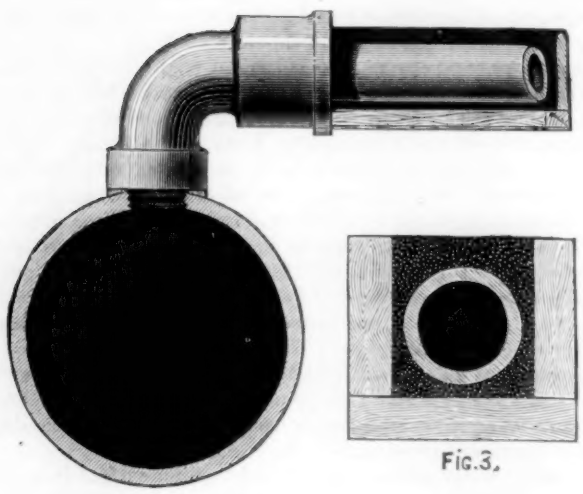

Fig.2.

Fig.3.

Several methods have been tried for preserving service pipes from the deleterious influences arriving from the nature of the soil and otherwise, in which they may be placed, which should be noticed here. Galvanizing has been tried for some time, and tubes prepared by this process are, I believe, being more extensively used. I am of opinion, however, that this method is one of doubtful utility. Dr. Barff's process is in the right direction, but as yet experience is wanting of its durability in the soil. I should suppose, too, that it cannot give any protection where the pipe is cut and screwed. The process, however, is one of undoubted interest to us as gas managers, and will, I am convinced, receive from us that attention which its importance demands.

I have indicated my preference for malleable iron tubing, and I do so not only on the ground of its adaptability, but also on the ground of its economy. The methods I adopt in laying are, I have no doubt, similar to those in use by many of you.

The accompanying diagrams show the mode of attaching the service pipe to the main, and of preserving the pipe when laid. Fig. 1 is a faucet side branch connection of cast iron, with screwed nipple. Fig. 2 is a faucet bend, also of cast iron, for fixing on the top of the main. The connection being secured, the pipe is laid in a wooden trough, as shown in section in fig. 3. Before bringing the pipe home into the faucet, a ruff, or back-set, should be put on the end of the pipe, to prevent any risk of the yarn slipping over, and it is secured in the faucet by a lead caulked joint in the the usual way. Melted pitch is then run all round and over the pipe in the trough, completely imbedding it therein, and when set the covering is quite impervious. I recently had occasion to take up a sevice pipe which I had laid, in the way described, ten years ago, and found the pitch perfectly intact, and the pipe clean and fresh, with no indication of corrosion.

The following table shows the relative cost of lead and malleable iron. I take 15 feet as the average length of service pipe, and the size ¾-inch:

Lead Service Pipe.

One ¾-inch brass coupling connection	1s. 3d.
15 feet of ¾-inch lead pipe, 5 lbs. per yard	4 0¾
Wood	0 7½
Labor	3 9
Total	9 8¼

Malleable Iron Service Pipe.

One cast iron faucet connection	0s. 5½d.
15 feet of ¾-inch malleable iron pipe, at 1¾d	2 2¼
Wooden trough	1 3
Pitch	0 2¼
Lead, yarn, and coals	0 3
Labor	3 8
Total	8 0

These figures show a difference in first cost in favor of iron of 1s. 8¼d.

Discussion.

The President said Mr. Mackenzie had introduced a paper of great interest to the profession generally, and he trusted that those present would favor the meeting with their views on the question.

Mr. John Young (Bonnyrigg) said he had been connected with gas manufacture for nearly 41 years, and the subject Mr. Mackenzie had introduced was one to which he had given much consideration. He had tried different kinds of pipes, and had tried them in a variety of soils. The duration of the pipes depended a good deal upon the nature of the materials to be found in the soil. When first he commenced business pipes were made exclusively of malleable iron. The soil in which his pipes were laid contained a considerable mixture of nitrogenous matter, and after an interval the pipes became completely inclosed in concrete, composed of oxide of iron and sand, which formed a huge mass, so much so that a ½-inch pipe which was afterward taken out could not have been less than 1½ inches in diameter. To the uninitiated it appeared most wonderful that there should have been collected such a large amount of material round such a small nucleus. He observed one very peculiar thing where a pipe had to cross a sewer. The liquid traveling along the sewer permeated to the pipe, which was soon corroded into holes. This led him to inquire into the circumstance, and he found that the amount of chlorine traveling along with the sewage had permeated the soil, and had corroded the material of the pipe. Abandoning this kind of pipe, he adapted lead; but even this substance was not able to resist the attacks of the soil. In some soils it was converted into carbonate of lead. On one occasion he remembered a person getting gas into his premises—and this was just another instance of people's stupidity—and the man had to bear the entire expense of the service pipes. He was a blacksmith, and in order to insure the safety of his service he used sifted smithy ashes to make a careful bed for it. But something went wrong, and he (Mr. Young) being connected with the gas works, was called in to ascertain the cause why it was that the pipe had only lasted eleven months. The smity ashes, of course, being sulphuret of iron, contained a large amount of sulphur. When this material became thoroughly saturated with water, it was converted into a sulphur acid, and attacked the lead pipe, which was corroded into holes like a flute. It might, no doubt, be said that lead now-a-days was not so absolutely pure as formerly; that it was now a composition of all sorts of dross and rubbish that could be drawn or squeezed into pipes

like sausages; that, indeed, it was a very different material, whatever the amalgam might be; and that it would just stand the pressure to be driven into the form of a pipe. There were generally materials in a pipe which tended to its own destruction, by establishing an electro-chemical action which insured certain destruction. Cast iron pipes he had found to be the most satisfactory, and during his connection with gas works he used nothing else; but short lead pipes were used when there required to be an insertion through a wall. Last winter's experience had shown him something very peculiar with respect to iron pipes. In one place, such was the expansion of the subsoil, through the effects of frost, that the main pipe was forced up and broken. With reference to the stoppage of pipes, he remembered on one occasion being sent for when the supply of gas to the half of a town had been stopped. He went to the place and ascertained that the pipe was carried over a bridge across a small stream. Here the pipe was actually closed with solid ice right through. They took a large quantity of joiner's shavings, filled up the arch, and set fire to the mass, and by-and-by there was such a heat through the arched stonework that in about half an hour gas was obtained in the part of the town that had been in darkness.

Mr. Watson (Stirling) remarked that Mr. Mackenzie had omitted in his estimate to credit the amount obtained for the old lead pipes. In comparing lead and iron, it should, he said, be noted that within 2s. 6d. of the original value could be obtained for old lead pipes.

Mr. G. R. Hislop (Paisley) said the members of the Association must all feel deeply indebted to Mr. Mackenzie for his practical paper. His (Mr. Hislop's) experience ran very much in the lines indicated by Mr. Young. For a long time now he had adopted cast iron services. In no case did he lay services of less than 1 inch in diameter, and he could not too seriously deprecate the practice of laying ¾-inch cast iron services, because they were too fragile, and indeed did not admit of a sufficient quantity of gas passing, however small the demand might be. In laying pipes of not less than an inch in diameter, provision was made, for all time to come, for any increased demand, whether the gas was to be used for heating or for cooking; and in these days, when they were threatened with competition, these were the two means which gas companies might command to extend consumption. Then the 1-inch service pipe, in addition to giving an ample supply of gas, was exceedingly durable. But, in laying their services, gas managers would require to be guided by the nature of the soil with which they had to deal. If saline soils, or soils mixed with ashes, prevailed, then there would be an excess of sulphur, and, as Mr. Young had indicated, malleable iron or lead pipes would soon become oxidized and destroyed. In certain parts of Paisley the main pipes were soon completely oxidized, so much so, indeed, that in ten or a dozen years there was nothing left but carbon or plumbago—the iron having rusted out of the pipes. The only precaution he took in laying pipes was to have them surrounded by good clay, where the soil was of the nature described. With respect to the matter of joining service pipes to the mains, the method shown by Mr. Mackenzie was a good one, and one which he (Mr. Hislop) had long used himself. Instead of screwing the service pipe direct into the main, it was a good plan to use cast iron pipes with malleable iron nipples, because in this way oxidation was prevented. But there was this difficulty, that the cast iron with malleable nipples could not very well be used; that was to say, a fair joint could not be made with anything below a 3-inch main. His experience also with regard to the freezing of pipes near the surface accorded very much with that of Mr. Mackenzie and Mr. Young. He had a 3-inch pipe which passed over a canal bridge, and there he found that the pipe had been filled solid with freezing watery vapor. The surface was so hard, and the supply through the main was so limited, that there was no justification either for the trouble or expense of thawing it. The consequence was that it was left to itself until in the natural course of events it came all right. With regard to the freezing of services, nothing in his experience had proved so efficacious as the introduction of a little spirits of wine. He had cured many dozens in this simple way.

Mr. McCrae (Dundee) said he could not agree with two points which Mr. Mackenzie had advanced. It was at all times objectionable to tap a cast iron pipe. He gave up the use of cast iron service pipes many years ago, because it was found that upon the slightest deflection of the surface of the soil the pipe would bend and break at the neck. A malleable iron pipe, with a saddle, and jointed with lead, made far better work. He agreed with Mr. Mackenzie's manner of preserving with a trough filled with pitch, but he would carry the trough to the point of junction with the main, instead of stopping at the faucet.

Mr. Robb (Haddington) said he had had experience with lead, malleable, and cast iron pipes. When he went to Haddington 34 years ago he found that all the services were of ½-inch malleable iron. These, however, he had discarded, and for some years he had used nothing else than ¾-inch and 1-inch services. His preference was for cast iron. He had tried lead pipes, and had found them handy—they were easily connected and easy to put in; but instead of having a fire in the street, he connected the pipes before sending them out with a coupling which did not require any soldering. Cast iron, however, he had found to be the best, and as there was so little difference in price between ¾-inch and 1-inch, and as the latter size made provision for the future, it would be well to lay only this size of service.

Mr. Smith (Aberdeen) said that the subject which Mr. Mackenzie had brought before the Association was undoubtedly an important one. It had been truly remarked by that gentleman that the dividends made in the retort house were often lost in the street. The connecting of service pipes to mains was a very "kittle" part in the work of a gas undertaking, at least he had found it so in his experience. The screwing of the nipple was a very good arrangement, provided experienced men were employed to execute the work, or if the manager were standing by to see the thread properly brought up; but if this were not efficiently done a great amount of leakage would be the result. It was with mains of small diameter that the difficulty would be most felt. In his experience there was nothing to surpass the method suggested by Mr. McCrae—namely, the saddle, with wrought iron strap and lead joint. Whether cast iron or lead pipes should be used depended greatly on the nature of the soil. In Aberdeen he found that cast iron pipes were best. He approved of cast iron services of not less than 1 inch in diameter, proved with 300 feet head of water.

Mr. Hislop—Do you apply the saddles to the smaller sizes?

Mr. Smith—To all sizes.

Mr. Hislop—I am inclined to think the soil destroys these straps in a short time.

Mr. W. Young (Clippens) said the few remarks he had to make scarcely bore directly on Mr. Mackenzie's paper, but were rather suggested by the observations which had been made with reference to the condition of a pipe which had been exposed to the action of sewage. The iron became entirely corroded and dissolved out, leaving, to all intents and purposes, a pipe of carbon or plumbago. At a recent meeting of the West of Scotland Association one of the members, the manager at Bo'ness, presented such a piece of pipe in order to elicit some information regarding it. Mr. Tervet, his assistant at Clippens, brought a piece of the pipe to the works, with the object of making some experiments upon it, and one of his experiments illustrated most beautifully the result brought about on a pipe in this condition. He formed it into a diffusometer—that was, he cut off a piece of the pipe, sealed it at one end, and attached the other end to a long piece of glass tube. Then he brought an atmosphere of hydrogen over the altered pipe, and immediately the hydrogen passed through the porous plumbago, and, as the diffusion of the hydrogen was greater than the air inside the pipe, the diffusive action of the pipe in this porous condition was shown by the bubbling of the inclosed gases from the bottom of the glass tube which had been plunged in a jar of water. On the other hand, when he removed the atmosphere of hydrogen, the hydrogen at once diffused from the pipe to the external air, and the water rose in the glass tube, showing clearly that when the pipe got into this porous state, gas would pass from it to the air, and that air would also pass into the gas. This proved that such a pipe, although not containing pores sufficiently large to admit of leakage in the ordinary way of transpiration, nevertheless led to loss through diffusion, and this in two ways: it not only allowed the escape of the combustible gases, but admitted atmospheric air, which, as they were all aware, greatly deteriorated the illuminating power of the gas. The experiment suggested an idea to him which he thought could be made available in practice for the elimination of the impurities that were contained in coal gas. For instance, he took the same piece of pipe, and having wetted it so as to fill its pores with water, he, on covering it with an atmosphere of hydrogen, found that it lost all its diffusive properties in so far as the hydrogen was concerned. The pores being filled with water, it would not allow the hydrogen to be transmitted; but on bringing over the pipe an atmosphere of sulphuretted hydrogen, or carbonic acid, a transmission of these gases was at once obtained through the water. This result was brought about by the power that water had of condensing carbonic acid and sulphuretted hydrogen, and converting them, so to speak, into a liquid form—dissolving and transmitting them by dialysis through the wet pores of the carbon pipe into the atmosphere inside thus showing in this wetted condition that it was a transmitter of these two gases. Now, the idea suggested itself to him that if they had a long series of pipes made of porous material similar in character to the pipe experimented with, and passed their crude gas, after being denuded of the ammonia, through these pipes, the consequence would be that the illuminating gas, which was practically insoluble in water, would be prevented from escaping, while the sulphuretted hydrogen, and other impurities soluble in water, would be transmitted to the outside, and could be conveyed away by washing, or by causing a current of air to pass over them to the chimney stack. He had not had time practically to test this, but many of the members of the Association who had time might try it. He thought it advisable to throw out the suggestion, as he believed there was something in it, and he would be pleased to hear that some of the members had made experi-

ments with a view to the practical solution of the problem—a problem to which, he might mention, Mr. Trevet was devoting attention. He might do so himself, and possibly communicate the results to some future meeting of the Association.

Mr. Esplin (Forfar) asked whether, before making the experiments, the oxidized matter surrounding the pipe had been removed, or whether these experiments had been conducted with the pipe in the state in which it had been removed from the ground. It would, he said, be interesting to know this, because many of them had been pinning their faith to the belief that so long as an iron pipe remained undisturbed, it was impervious in every sense.

Mr. Young said that when he saw the pipe it consisted almost entirely of the carbonaceous portion. The external crust had been removed; but at the same time he had no doubt it would not have made any material difference, from the fact that the surrounding crust, which was oxide mixed with sand, was very porous indeed. It would only be when the pipe was dry and porous, and filled with gaseous matter, that it would act as he had described.

Mr. Mackenzie, in reply, said he was much obliged to the members for the kind remarks which had been made in connection with his paper. As to the observations of Mr. Watson relative to crediting the value of old lead pipes, he thought that at the end of 20 years, and taking into account the value of the old lead, malleable iron would still be found to be the cheaper material. Several of the speakers had expressed themselves in favor of cast iron pipes, and all he could say was that the question of durability very much depended upon the locality and the nature of the soil. With cast iron pipes of 1-inch bore he had often experienced breaks by subsidence, and then there was a considerable escape of gas. With respect to the connection with the main, he had not experienced the difficulty to which Mr. McCrae had referred, and the plan he adopted was very much cheaper than working with the saddle.

The President, in proposing a vote of thanks to Mr. Mackenzie, said that one important part of the subject had not been taken up, and this was in regard to the depth at which a pipe ought to be laid. It was important, in his opinion, that service pipes should have a covering of at least 24 inches. There was no question that the soil had an effect upon the metal that was used for services, but he preferred malleable iron covered with a coating of tar, as he had found that services put in in this way lasted a long time. In a soft soil or where there was heavy traffic malleable iron was not so liable to break as cast iron, and in this way also a great deal of mischief was avoided. He did not think the nipple and socket advocated by Mr. Mackenzie made quite so satisfactory a job as the saddle referred to by Mr. McCrae. No doubt the saddle cost more than the other arrangement, but it was worth all the difference in the price. He thought that by Mr. Mackenzie's arrangement it would be very difficult to make the lead joint without hurting the screw—that was to say, when staving up the lead joint the workman would be apt to make the nipple shake, and in this way produce an unsatisfactory job, more especially with the bent connection.

Dr. Lattimore's Report on the Illuminating Gas of Rochester.

CHEMICAL LABORATORY,
UNIVERSITY OF ROCHESTER,
August 31, 1881.

To the Board of Health of the City of Rochester:

Gentlemen—In compliance with your request that I should make such a chemical analysis of the illuminating gas manufactured and sold by the several gas companies as would place you in possession of the knowledge of the exact composition of each, I now have the honor to present to you the results of my investigations in tabulated form.

Having already enjoyed the opportunity, in the laboratory of the University, of explaining and experimentally illustrating to your Board, as well as to the officers representing each of the corporations immediately concerned, and who were present at the same time by my invitation, technical methods employed in the analysis, I need not repeat them here.

Such a series of analyses made simultaneously offers many suggestions of scientific and technical interest concerning the processes involved in the manufacture of gas, especially where the practical results of different methods are thus rigidly tested, side by side, under identical conditions. A parallel series of photometric tests, showing the relative commercial value of these gases, and especially the relation of this illuminating power to the chemical composition, would likewise be interesting, both to manufacturers and consumers.

But as this investigation has been made for sanitary purposes, and not in the interest of science or commerce, I limit this report strictly to the analytical results for which you have asked, with only such brief explanation as may seem necessary to render them intelligible.

In examining the accompanying table it is necessary to bear in mind that the gas of the Rochester Gas Light Company, and also that of the Citizens' Gas Company, is obtained in the ordinary way by the destructive distillation of bituminous coal, while that of the Municipal Gas Company is produced by a radically different method, the essential points of which are these: Into a chamber filled with incandescent anthracite coal a jet of steam is forced, suffering decomposition into its constituent elements, hydrogen and oxygen, the latter instantly recombining chemically with carbon, forming carbonic acid and carbonic oxide. This part of the process, therefore, yields a mixture of these two gases together with hydrogen, resulting from the decomposition of steam. This mixture is "water gas" proper. While it is readily combustible, its flame is non-luminous, and consequently without value for ordinary use. To confer upon it the lacking property, gases of high illuminating power are produced by one of several distinct methods, and added to the water gas in such proportions as to confer upon it the desired illuminating power. The Municipal Gas Company of this city produces this enriching gas by the destructive distillation of petroleum. The hydrocarbon gases thus obtained are mixed with water gas, and the product subsequently subjected to the ordinary modes of purification, storage, and distribution.

It is proper to call attention to the fact that the first sample of the gas of the Municipal Gas Company—No. 7—was taken only a few days after the works were put in operation.

Sulphuretted hydrogen was tested for qualitatively in all the gases, but as it was not found, it has not been entered in the table.

The table shows the percentage composition by volume.

COMPANY.	Hydrogen.	Marsh Gas.	Carbonic Oxide.	Illuminants.	Carbonic Acid.	Nitrogen.	Oxygen.	Specific Gravity.
Rochester Gas Lt. Co.								
Sample 1...	52.79	31.50	5.00	5.00	0.00	2.70	1.00	.3920
" 2...	52.42	34.41	5.20	4.40	0.00	1.44	0.20	.3717
" 3...	56.07	32.04	5.40	3.20	0.20	4.45	0.20	.4216
Citizens' Gas Co.—								
Sample 4...	47.25	38.00	5.80	4.00	0.00	3.30	1.20	.4104
" 5...	48.20	39.80	5.00	3.80	0.00	3.00	0.20	.3947
" 6...	50.53	35.28	6.20	4.00	0.60	3.41	0.00	.4563
Municipal Gas Co.—								
Sample 7...	10.34	22.72	7.00	21.00	1.00	40.18	0.00	.8462
" 8...	26.03	17.07	20.60	14.40	1.20	22.14	0.40	.8158
" 9...	27.05	17.03	20.00	12.00	1.50	21.48	1.00	.8371
" 10...	31.58	13.16	19.80	11.80	2.00	21.06	0.60	.7642

The samples for analysis were collected as follows:

No. 1—Paine's drug store, January 15.
No. 2—Paine's drug store, August 18.
No. 3—Paine's drug store, August 25.
No. 4—Chemical laboratory, August 20.
No. 5—Chemical laboratory, August 23.
No. 6—No. 29 Prince street, August 25.
No. 7—Company's works, January 15.
No. 8—Siddon's, No. 84 East Main street, August 18.
No. 9—Siddon's, August 23.
No. 10—Sibley, Lindsay & Curr's, East Main street, August 25.

Respectfully submitted,
S. A. LATTIMORE.

SMOKE-CONSUMING FURNACE.—A trial of a smoke-consuming furnace took place recently in Boston. Among the substances that were put on the fire were wet grass, rubber, shavings, and swill, but all were consumed without the smoke being visible on the outside, except for about half a minute when the furnace door was open. This result is obtained by conducting air from outside the furnace through pipes that are laid over the fire, the air circulating through them becoming superheated and igniting the smoke before it reaches the stack, causing intense heat with but little draught. The fire was first kindled with hard coal, and the wet substances afterward put on did not cool the fire, but seemed to add fuel to the flame.

Grumbling at Gas Bills.

The London *Builder*, in making some comments on the exhibition of gas cooking and heating appliances recently made by the Welshpool Gas Company, of Great Britain, speaks the following in relation to the habit of growling at gas bills—

To people who have a chronic habit of grumbling at their gas bills, the following may be of assistance in both clearing up the cause and reducing the bills at the same time. Some months ago a family whose gas bill for lighting only amounted to over 5d. per day (130 cubic feet), asked Mr. Fletcher, of Warrington, to supply them with a complete set of gas cooking apparatus. On being asked what the probable cost of gas for cooking would be for a family of seven, he gave it as about 1½d. per day as a maximum. This statement was looked upon as an absurdity, and to catch him napping the meter was closely watched day by day at different hours. The consequence was that the meter dial was seen to be constantly on the move, even when no gas was used. An examination was made, and a considerable leakage was discovered and made good. When this was made right, the gas consumption, as indicated by the meter, at once dropped to 72 cubic feet per day—less than 3d. for both lighting and cooking. As this reduction was brought about indirectly by the introduction of gas cooking, it may be practically said that the cooking costs two pence less than nothing per day. Immediately behind the dial of a gas meter, in the same little box, will be seen a small horizontal drum, with the figures one and two on it. This drum revolves once for every two cubic feet passing, and those who doubt their gas bills can easily see for themselves whether any gas is passing when all the taps are turned off. If when no gas is being used this drum revolves once in half an hour, the waste of gas at 3s.6d. per 1000 cubic feet will be equal to 4d. per day, or about £6 per annum. If the drum revolved once in two hours with all taps closed the leakage would be quite sufficient to pay the expense of a thorough search for it, and show a handsome profit.

Most people have an idea that if there is any leakage of gas they would be sure to smell it. This is a mistake ; leakages of the worst kind occur frequently under floors which have often a free current of air passing, these leakages being often caused by nailing carpets, etc., down, and from the free ventilation underneath the leakage is not at all likely to be discovered except by the movement of the meter. As the watching of the meter is a simple matter, costing nothing, the suggestion is one which is well worthy of attention.

Coal Tar and Artificial Indigo, Etc.

Of the many valuable and beautiful products from coal tar another most important one has been brought into notice, for Dr. Caro has introduced a process by which indigo by artificial means has been brought within a measurable distance of commercial success. The indigo has been reproduced by building it up from its constituents, existing in tolume as a product of coal tar.

Recently Professor Roscoe pointed out how identical the two indigoes were in their properties. This is following up the discovery made a few years ago of alizarine, the coloring matter of madder. To two German chemists, Graebe and Liebermann, we are indebted for the discovery that alizarine, the coloring principle of madder, was derived from anthracene, one of the hydrocarburets that are met with in coal tar. Their researches caused them to believe in the analogy existing between alizarine and certain bodies of the coal series, and found that it was possible to convert the natural alizarine into anthracene by heating the former with powdered zinc. It was then considered that if the process could be reversed and the anthracene converted into alizarine, the great discovery would be accomplished. This was effected, and the long-sought for alizarine was produced, and it was found in every essential identical with that which had been formerly obtained from the madder root.

Unexpected chemical discoveries, it may be said, are often made when not being sought for, and that has been the case with Mr. Perkins, who, in trying to produce quinine artificially, made the discovery of mauveline. Of mineral colors the most important so far is that of ultramarine the most highly esteemed and the most largely employed of blue colors with indigo. Its artificial production was discovered in Germany by Gruelin about fifty years ago, but, at the same time, and probably quite independently, in France it was being made up for use by Mons. Guimet. Now we are told the synthesis of indigo has been accomplished by Professor Adolph Baeryer of Munich, showing the valuable results of the study of organic chemistry. Indigo is insoluble in water, alkalies, alcohol, and most common liquids, and forms a blue powder, but by combination with hydrogen is transformed into indigo white. This rapidly absorbs oxygen from the air in dyeing, and then passes into the blue insoluble indigo, and being held in the fibre of the cloth gives it a permanent blue dye.

The production of artificial indigo will have the effect, as has been the case with all other dyes, of greatly lessening the cost of them. Of the many artificial and other dyes it is somewhat singular to find that nearly all of them are manufactured in Germany, and not a few of them have been discovered by German chemists. Germany also excels in the preparations, always carefully concealed, of the carmine of cochineal, and the most beautiful flakes are also produced by the German manufactures, and flakes of indigo and saffron are prepared in Berlin.

It is, however, a notable fact that the raw material from which many of the dyes are extracted in Germany are imported from England, and are taken back in their manufactured state. Indeed Germany sends her dyes to every part of the world, and it is certainly singular with English capital and enterprise in abundance such an important branch of industry, and so profitable withal, has not been started and taken root here, but instead of which we should have to depend upon foreigners for articles of which we are the largest consumers, but which we could produce, in many instances, at a less cost than they could abroad.—London *Mining Journal.*

Overhead Heating.

The system of overhed heating in manufactories and mills by means of steam pipes is being very generally adopted in New England, and is recommended by the insurance companies.

The first objection usually made is that heat rises, but, in point of fact, the connection of heat from pipes is by radiation, and does not follow special direction either upward or downward under the usual conditions of a factory. It is simply a question of diffusion, and the best place for the pipe is where the radiation or diffusion is effected in the best manner. One of the greatest dangers to which factory buildings are exposed, and one of the heaviest causes of loss, is the collection of combustible matter on steam pipes, where they are ordinarily placed at the sides of the room under the windows. Mr. Edward Atkinson, President of the Boston Manufacturers Mutual Fire Insurance Company, recently addressed a circular to the managers of 52 mills, where this system is employed, asking a number of questions to draw from them the results of their experience with overhead pipes, and received 42 answers. Out of the 42 replies two were unfavorable ; two were unfavorable, but were qualified by statements that showed their apparatus to be poor ; one was favorable with exceptions, and 37 were absolutely favorable. In respect to economy in heating the answers varied from nothing to 25 per cent. saved, and the greatest saving was shown where the pipes were away from the wood and brickwork, and therefore lost nothing by having the heat conducted away. Among the mills which sent favorable answers are many of the largest in the country, and they do not speak until they have thoroughly tested the system.

The coils of the pipe are generally placed about two feet from the ceiling on hanging brackets from the beams, and 1¼-inch pipe is the best adapted for the purpose. In addition to the safety from fire, there is the economy of space and every inch of floor space is availed of. The system is one that should commend itself to those who are engaged in the manufacture of inflammable articles.—*Iron Age.*

Note on Sulphuretted Hydrogen.

By P. Casamajor.

In 1873, Mr. William Skey, Analyst to the Geological Survey of New Zealand, published some interesting observations on the production of sulphuretted hydrogen when a voltaic couple is formed with zinc as the positive and a metallic sulphuret as the negative plate. When placed in contact with zinc or in communication with this metal, by means of a wire, many sulphurets give sulphuretted hydrogen very freely with sulphuric acid or hydrochloric acid, which alone would not give any in contact with these acids. This happens with galena and sulphuret of copper. I have had occasion lately to apply these researches of Mr. Skey to the production of sulphuretted hydrogen from sulphuret of iron, which refused to give it in presence of sulphuric acid diluted with ten times its volume of water. I believe that the greater part of the sulphuret of iron sold to chemists possesses this resistance to acids. I have lately found none that gave sulphuretted hydrogen easily, and I had accumulated several pounds possessing this undesirable quality.

After a few trials I was able to obtain an abundant supply of sulphuretted hydrogen from any sample of sulphuret of iron, by proceeding in the following manner :

Enough mercury is put in a bottle to cover the bottom entirely. Over this, diluted sulphuric acid is poured, and some pieces of zinc are thrown in, which immediately sink into the mercury, forming a zinc amalgam with great excess of mercury. No action takes place between the zinc and the acid. If, now, a few pieces of sulphuret of iron are thrown in the bottle, they will sink to the mercury, and a copious production of sulphuretted hydrogen will take place from the surface of the sulphuret. This production will continue with remarkable regularity until either the zinc, the sulphuret

of iron, or the sulphuric acid is exhausted. As to the mercury it only intervenes indirectly in the reaction, and it does not require to be renewed.

In place of sulphuret of iron, I have tried galena, iron pyrites, and copper pyrites. These all give sulphuretted hydrogen, but very slowly. With galena, the action soon ceases, as the mineral becomes coated with sulphate of lead. By leaving galena in contact with liquid zinc amalgam for several hours, the surface of the mineral becomes coated with a bright coat of lead amalgam.

With iron and copper pyrites, comparatively little sulphuretted hydrogen is given off, but there is a considerable production of hydrogen. In this case the sulphurets act mainly as conductors, in the same manner as a piece of retort carbon.—*Chem. News.*

Flint Fire Bricks.

A new manufacture has recently sprung up in our midst, says the London *News*, and one which promises well for those who have embarked in it. This is the manufacture of fire-bricks from flints, at works which have lately been started at Charlton, Kent, by the Thames Flint Fire-brick Company, of which Mr. E R. Salwey is the manager. These works are favorably situated as regards transport, having a river frontage and railway communication, but still more favorably as regards the raw material, which abounds in the neighborhood. The bricks are manufactured under Mr. Henry Edward's patent, the process of manufacture being as follows:

The flint stones are first thoroughly calcined in special furnaces constructed for the purpose. The calcined flint is then transferred to a fixed pan in which revolves a pair of heavy edge-runners. The limestone is also burned in a kiln in the usual manner and deposited in a tank, into which water is introduced, and the burnt lime is there partially dissolved. The water in which the lime has been partially dissolved is run into another tank and there allowed to settle, and a proportion of the lime deposits at the bottom of the tank. The lime water is conveyed by pipes to the pan of the edge-runners in which the flint has been deposited, enough lime water being introduced to moisten the flint sufficiently for a thorough mixing. The revolving runners grind and thoroughly mix the mass, taking about a quarter of an hour for each charge of one ton of flint and lime water.

When the mass has been ground and mixed sufficiently for the purpose for which it is intended, it is removed from the pan through a sluice in the bottom. The plastic composition thus formed may be at once moulded into brick, but it is improved and brought to a better temper by being kept for a few hours before moulding, which plan is usually adopted. The moulding, drying and baking processes are effected in the manner usual in the manufacture of the Dinas fire-brick or stone fire-bricks generally. The fire cement is brought into fit condition for sale by drying the plastic compound after it leaves the pan and re-grinding it when dry. It is then ready to be packed in bags or casks for the market.

By this method of manufacture, fine goods are produced which consist of nearly pure silica, and which are said to be quite as capable of resisting intense heat as the Dinas fire-bricks, if not more so. These bricks have been tried in various steel and iron works in furnaces developing intense heat, including the Siemens regenerative furnaces, and the results in all cases are reported to be most satisfactory.

This manufacture is most interesting and important, as showing how a material which exists in great abundance in the locality, and hitherto of little value in the industrial arts, may be turned to good account in producing the only fire-brick of the class manufactured in the neighborhood of London, the products being of exceptionally high quality.—*Iron Age.*

Electric Lighting at Cardiff

The correspondent, whose account of the trial of the electric light at Cardiff was published in our issue of the 2d inst., sends the following account of "further escapades"—

The electric lights in use at the large drill-hall in Cardiff during the Exhibition of Fine Arts are giving the committee considerable exercise and trouble, not unmixed with anxiety. The committee are responsible for drawing a large concourse of persons together to witness the many valuable objects collected within the largest building in the town. Previously, gas has admirably answered every requirement as an illuminant within its walls; but, of course, something modern and more pretentious than gas was needed for the exhibition.

The electric lipht was the consequence of such an idea gaining ground, and to the movement we are indebted for a novel proceeding on the part of the present method of attempting to light up a great space by its aid. A large building and large open spaces are the *fortes* claimed as special vantage-ground for the electric light. The exhibition is accompanied each day with performances, chiefly vocal and instrumental, of a high order. One evening last week circumstances of a somewhat grim character seemed to coincide, with a view to give a life-like, or rather a death-like reality to this particular occasion. An *artiste* was announced to sing the "Death of Nelson," and a crowded audience was present. The electric light had apparently its part, or *role*, allotted to it, for when the singer commenced the song the electric light suddenly disappeared. Of course the gas was immediately called upon to do duty in the emergency.

From previous experience of the electric light this was a contingency quite looked for; the committee having very thoughtfully ordered that the gas should be *lit up* but *turned down* so as to have it ready if unexpectedly required. The man in charge of the hall was quickly on the alert, and the gas-tap was manipulated, but to the intense disappointment of the committee in particular, and the disgust of the public in general, the tap was turned the wrong way! Thus the small glimmer of gas kept in waiting for the electric lights to perform one of their "fantastic tricks," was put out, and all was darkness.

Is not this a burlesque on lighting? The meeting thus had an unpleasant, but withal a somewhat grotesque ending. Strange things within and yet stranger things without. The large hall thus lighted is by one electric system which shall be nameless; the approach to the hall, in Dumfries Place, is also lighted by electricity, but by a separate and entirely different system. As the audience left the large but dismal hall, and emerged into Dumfries Place with its brilliant lights, the effect upon the visual organs was most marked and indeed painful.

This sensation was of short duration, and had instantaneously to give way to another quite as bad. The electric lights were by some means unexpectedly extinguished, and where a few moments before everything seemed to be absorbed in an effulgence of light nothing but universal blackness prevailed. This is called electric lighting; but some people are beginning to think a far more suitable term might be found with which to describe such a new fangled method of extracting sums of money from those who seem to expect something better than gas for their pains.—*Journal of Gas Lighting.*

[Translated for the AMERICAN GAS LIGHT JOURNAL.]

Some Results Obtained at Angers by the Application of New Methods for the Condensation of Gas by Heat.

By M. DAUGE.

In an interesting article presented to the last convention, by M. Cadel, Manager at St. Etienne, this distinguished gentleman gave an account of an experiment made by him in his works of a new theory on the condensation of gas.

This important communication has excited the attention and stimulated the zeal and study of a great many of our confreres. For our part, taking for guide the information furnished by the work of so consummate a master in questions of this kind, we have undertaken, at the Anger's works, a series of experiments which have yielded us such very interesting results that we feel it to be our duty to communicate them to you.

That which is at first astonishing in the study of the new method is, first, the boiling point of the benzoles contained in gas tar is about 80°; as a consequence, if the gas containing these benzoles is heated to a temperature above 80°, they are transformed into vapors which assimilate with the gas and enrich its illuminating power.

The second point, which seems to us to be even still more important, is the bad influence of weighty tars, especially when cold, on the illuminating power of gas. It is then absolutely necessary to employ every means to avoid their presence. Light tars, on the contrary, containing the principles which supply gas its illuminating power, ought to be studied and treated in some certain conditions. The union of light hydrocarburets, by affinity with the heavy hydrocarburets, being a recognized fact, it will be necessary then to avoid the precipitation of the one by the other, and to separate the gas from the heavy tars by means of a proper temperature.

Finally, to realize these conditions, we have fitted to each bench of retorts, and surrounded with a double course of bricks, some small barrels, cylindrical in form, of two meters in diameter, and whose volumes had been calculated on the basis of three cubic meters per thousand cubic meters of gas manufactured in 24 hours. Last September our works were provided with these appurtenances. When fully charged the temperature of the barrels did not exceed 50°; but by means of a powerful jet of steam, it has been easy for us to reach 80°—we have even exceeded 120°.

At the first of these two temperatures we have ascertained that when the very small quantity of condensed tar begins to undergo distillation, it forms itself into a rosin, the flow of which, even in a vertical conduit, and, notably during the cold of last winter, was completely stopped. The more we exceeded 80° the more these accidents were to be feared; and the less we exceeded 80°, on the other hand, the quantity of heavy condensed tar was increased considerably.

At 120° the artificial barrels condensed nothing more, although the result aimed at was by no means reached.

On the other hand, the gas maintained in the artificial barrels at an elevated temperature, charged with steam, passed through the gas chambers, consisting of thin sheet iron pipes of the diameter of 0.60 meters, the volume of which is about 1½ cubic meters per 1000 cubic meters of gas made in December, per 24 hours, to reach the mouth of the condensers at 55°. At this temperature, the tubular condensers, with running water, the surface of which is, however, six square meters per 1000 cubic meters of gas made in 24 hours, was found entirely insufficient, for, on leaving this apparatus, the gas was found to be only 40°, and, consequently, the works would not condense their own gas either by heat or by cold. These two operations seemed to us to be equally important—the first ought to effect by heat, and in the best possible conditions, the separation of the heavy tars from the gas; the second having for object the separation of the light tars by cold, before their passage into the purifiers.

But you know, gentlemen, the light tars are the natural dissolvents of naphthaline. Now, if we do not precipitate the one the other is drawn along with the gas and produces the stoppages in the entrances of the pipes of the gasometers, as we have frequently ascertained. This unmanageable product remaining in the works, as a result of the new method, we have not discovered in the city either deposits or obstructions of conduits or branches due to its presence, while the winter previous the ducts were full of it.

As far as regards the illuminating power of gas, we have no observations to make; but our method in the works being more practical, we have been obliged to modify it completely, and to leave untried a temperature of gas higher than 80°, which we had always considered, up to this time, as calculated to solve the problem. We have completely done away with jets of steam in the artificial barrels, and have placed in their stead streams of ammoniacal water, like those which flow in the barrels intended to prevent the contact of the gas with heavy tar. That part of the artificial barrel fastened in the solid wall was dismantled of its brick covering, and streams of cold water were poured on the surface. Under these conditions, the temperature of the gas in the artificial barrel suddenly fell to 45°, which is, at least, that of the gas in the barrels.

These modifications yield this result that the production of tar in the retorts is, in round numbers, about four per cent. of the distilled carbon, that of the artificial barrel one-half per cent. of a very liquid tar, the flow of which is regulated in a normal manner in ordinary conduits. We have ascertained besides that the gas passed through the gas chambers without leaving any condensible products; but it must be borne in mind that these chambers are enveloped with an isolating material. We believe this precaution to be very important, for it gives us the assurance (the gas being at 30° at the greatest on entering the condensers) that the artificial barrel is a true condenser, and that it has retained, by heat, all the heavy tars. This separation taking place rapidly and completely, in the retorts and artificial barrel, proves that (in the gas chambers) this product is in contact only with the light tars.

We are of the opinion that, in order to accomplish the double operation of which we have just spoken, and to which we attach the greatest importance, considerable volume should be given the artificial barrel and the gas chambers.

For Angers we think three cubic meters for the artificial barrel and one and a-half cubic meters for the gas chambers are not sufficient; and in order to obtain a complete separation of the heavy tars, a very moderate velocity should be given the gas in the artificial barrel; and for the purpose of arriving at the greatest assimilation of the light hydrocarburets, on the contrary, the contact of the light tars with the gas ought to be prolonged.

Before proceeding to set forth the results obtained under the above-mentioned conditions, we believe that we are in a position to affirm, from our experience at Angers with English coal (Lambton) distilled in six hours, in benches of nines (large retorts) the 80° temperature is useless, and that the great benefits, which it is pretended are to be derived by means of the new method of condensation, are completely independent of that temperature.

For Angers, the important point seems to consist in not volatilizing, by means of a higher temperature than 80°, those products which are found in a liquid state in the gas in order to increase its illuminating power, and this by a procedure which strongly resembles an artificial carburetting of the gas, of which the results are known; but that the whole method consists in preserving, during the process of distillation, and at all points in the gas, the benzole vapors, and to avoid the union, by affinity, of the light hydrocarburets with those which are heavier.

The temperature of the gas on leaving the ordinary condensers remains regulated at 12°; from this we may conclude that the condensation by heat in the artificial barrel is operated with regularity until it frees the gas from all heavy tars. On the other hand the condensation by heat in the tubular water condensers frees the gas from all the light tars.

To obtain an accurate idea of the wonderful results obtained at Angers by the adoption of the new method, it will be necessary to refer to previous winters; for every night, particularly during October last, all the plumbers of our works were employed in blowing out the service pipes of our subscribers, which were choked up with naphthaline; the lamp-lighters were busy in their departments with the jet-pipes.

The deposits of naphthaline were made in the city at the change of the seasons, and so abundantly that conduits of 81 millimeters and less were completely choked up. On the surface, as a souvenir of all these afflictions, we used a steam boiler mounted on wheels, to be seen moving through the streets of Angers, injecting steam, and especially warm water, into the mains.

To complete the picture, we must add that the conduits at the works were not any more exempted than those in the streets, and very often steam was the only means to prevent entire interruption in the service.

For this reason during the severe winter of 1879 the number of choked-up service pipes, on account of the frost, was very great.

Ever since the new condensation system has been in regular operation, we have not discovered any traces of naphthaline in the city or at the works; some obstructions were noted in a small number of service pipes, but not due to the presence of naphthaline; and during a few cold days that occurred in January last, when a few lamps were extinguished in the city, it seemed to us needless to inquire into the cause.

In December last, with a consumption per hour, at the works, of 800 cubic meters more than that of October, with the same pressure at the works during the two months, we have authenticated in the city pressures from 8 to 10 millimeters higher in December as compared with October; then the gas manufactured by the new method of condensation produced no more naphthaline, and, in fact, dissolved that already deposited in the mains during preceding years. Finally, a few days ago, we had occasion to replace a main, capable of supplying 400 millimeters, which showed not even the slightest trace of naphthaline.

Here, then, is the result absolutely accomplished, to wit: Heavy tars, in precipitating themselves rapidly, and at a certain temperature, bring over a greater or less quantity of naphthaline; just as well as gas charged with a greater proportion of light essences holds also naphthaline completely imprisoned. Whatever the true theory may be, we are positive that the adoption of the new system at Angers has freed us completely from the presence of naphthaline.

As to illuminating power, the results, though appreciable, are less marked. We ought to say, however, that, of the two benches of retorts fitted with this new appliance, one only is mounted with large snuff-box shaped barrels, with drainage for the tar at the base at 35°; with these arrangements we are certain that the plungers dip all the time in the water, and that the tar is constantly renewed.

But in the second bench the barrels are small, and the plungers dip into the tar, which runs very freely, at a temperature of 50°. The theory forbids such a disposition. However, thanks beyond all doubt to this high temperature, the comparative experiments that we have been able to make with the two benches, do not permit us to note any very appreciable differences in the illuminating power of the gas. Whatever may have been the cause of it in the preceding years we were compelled, in order to maintain the illuminating power at the mean proportion of 104 liters, to employ three per cent. of cannel coal; during last winter we entirely abandoned the use of this coal, and the mean proportion of the photometric tests gave us 102 liters with a regularity heretofore unknown.

We ought to add in favor of the new method that, with the same coals, the produce in gas this year has been one-half per cent. higher than that of 1879. It is hardly necessary to add that the benches of "nines" stand back to back, and are charged in such a manner that the end of the charge in one corresponds with the commencement of the other.

In reconciling the fact that the gas made at Angers by the new process has the property of drawing along the naphthaline deposited in the mains with that announced by M. Cadel, who pretends not to have been able to recognize the extraordinary effect that he had pointed out to us in 1879, under the same conditions, would not we be authorized to believe that there might be also an artificial means of enriching the gas in replenishing the naphthaline at the beginning of winter, from reservoirs which could be located at certain points along the mains; for we know that, at the ordinary temperature, gas, freed from heavy hydrocarburets, can attract considerable quantities of light hydrocarburets.

In fact, at 15° the point of the saturation of gas in hydrocarburets is 220 grammes; the ordinary tar of gas works containing 12 grammes of it, the gas 45 grammes, we are therefore very far from the point of saturation, and we have no longer to fear condensation. And as one gramme additional of a hydrocarburet in one cubic meter of gas adds two per cent. to its illuminating power, we have at our disposal a very powerful means of varying the kind of gas.

We will conclude these few notes by giving some totals indicating the comparative results obtained by distilling two sample quantities of tar, the

one accruing from distillation with condensation by heat, the other obtained in the ordinary conditions:

The first tar gave in light oil at 16½° Baume two per cent.	305
The second..... two per cent.	385

In the first instance, as we see, the production of light oil is a little weaker. From smaller distillations, we have obtained in commercial essences (benzole and benzine) the following results per 100 parts of tar:

In the first case—

In boiling benzole, from 85 to 110°.....	0.414
Benzine	0.371
Total.....	0.785

In the second case—

In benzole, same temperature.....	0.529
In benzine.....	0.339
Total.....	0.868

As is evident, the proportion of the more volatile products is not so strong in the first instance as in the second; the proportion of benzine (the heavier) is, on the contrary, a little greater. We can say, then, that the tars obtained at Angers, by the new process, contain fewer volatile substances, that they have less importance than ordinary tars, and that, as a consequence, these products are diffused through the gas and increase its illuminating power.

In fine, nothing is more simple and inexpensive than the application of this new method, the results of which are of the highest importance to gas works.

1st. A small snuff-box shaped barrel in which the gas enters (dabbles) into the water, and in which the tar deposits itself.

2d. An artificial barrel, with a sheet of water at the bottom, to prevent the contact of the gas with the heavy tars. The coal used, the dimensions of this apparatus, and the temperature which ought to be preserved in maintaining the gas, can be varied for the purpose of obtaining the dissolution of free naphtha in the heavy tars and the maximum illuminating power.

3d. A condenser, with *jeu d'orgues* (tubular), and running water, intended to produce condensation by cold, which is as important as condensation by heat.—*Journal des Usines a Gaz.*

Electrical Perils.

Some apprehensions have been expressed that a new and peculiar risk arises from the operation of electric lighting in large cities, both to persons and property. The alleged danger to property consists in the liability of an ignition of combustible material by the immense force of electricity which the lighting wires convey, if by any displacement of the wire it should be brought into contact with such material. The danger to persons thus alleged is confessedly not great as regards the number who might be thus exposed; but whenever an instance should occur of such exposure the effect, it is claimed, would be serious to the individual. The most likely manner of its occurrence is in the event that firemen in operating near a burning building might by accident or necessity break one of these wires. Under such circumstances, should a fireman happen for any reason to grasp the two ends of the severed wire the electrical current would instantly be completed, and the force of the current would be so great as to deprive the man of his consciousness and possibly of his life.

The managers of the electric light claim, on the other hand, that in case of a breaking of the wire the operator at the building where the electricity is generated would discover it at once and shut off the current immediately. In regard to the danger from fire they say that as their wire is thoroughly covered and insulated its falling upon any combustible object would not ignite it, and that in case the wire were broken no flame or spark would be thrown out unless the two broken ends lay within an eighth of an inch of each other. They refer with confidence to their experience of the past year throughout the United States as showing that the danger, if any, is so remote as to be no ground for apprehension. They think it even less likely than that it should come through an explosion of an accumulated gas which had leaked, or by failure to close a faucet had escaped into a building. Such explosions are not of frequent occurrence, and though exceedingly dangerous both to properly and life, have not led to any suggestion that public peril attends the use of gas. The willingness of insurance companies to take risks on buildings lighted by electricity on terms as favorable as any, is regarded as a guarantee of safety sufficient to maintain public confidence in the new method of lighting.

Per contra, there is at least one experience of a recent date that apparently demonstrates the reality of the risk. It is a curious coincidence that the property thus exposed is owned by the Boston Gas Light Company. This company has a number of telephone wires which connect its several gasholders or reservoirs with the manufactory at the North End. Three or four evenings since the man who has charge of the Federal street gasholder and who has a telephone apparatus and bell in his dwelling-house, and an employee in the office of the gas works at the North End simultaneously discovered that their respective pieces of apparatus were smoking with heat. Each acting upon his own judgment instantly did the prudent and proper thing, which was to switch of the electrical current, and so the igniting process was seasonably stopped. It had gone so far, however, that the hard and soft rubber that entered into the construction of the telephone apparatus had melted quite out of shape, and in one of the machines had been mostly consumed. One or two small pieces of paper which had been inserted somewhere in the machine for the purpose, it is understood, of deadening the sound, had become browned with heat and was nearly reduced to tinder. The apparatus is constructed mostly of metal, but it has for its base a thin block or flat piece of wood.

The hour was about 7:30 P.M., and fortunately employes of the company were at hand and promptly arrested the mischief. It is impossible to say positively that had the affair taken place later, when no one would have been present, that the wooden base of each machine and the wooden shelf on which it stood would have become fully ignited by the powerful current of electricity that was flowing in; but it cannot be questioned that the situation was a hazardous one in this instance. On the next day when the repairer of the telephone wires went to search for the cause of the trouble, he found and reported that it was the electric lighting wire which had come into contact somehow with the telephone wire of the gas company. The coincidence that the risk in this case fell upon a rival lighting corporation, might with some readers discredit the story. But the superintendent of the gas works, Mr. C. D. Lamson, has the two ruined and partly molten telephone machines in his possession, and they tell their own story.—Boston *Daily Advertiser.*

The Wonderful Weather.

Everything pertaining to tawny Tuesday is of peculiar interest. It is interesting reading now, and will in after years be quoted in connection with the meteorological phenomena of 1881.

The records of the Boston Gas Light Company, Boston, Mass., show the extensive use of gas during that day. The automatic register at the works indicated the pressure on the street mains to have been steadily at 1.8 inches until noon. During the following two hours the pressure was reduced .3 inch, as the record sheet shows. The next two and a-half hours reduced the pressure .6, bringing it down to less than an inch, or .9, which was the lowest point, the hour being 4:30 P.M. By 5 P.M. the drain was relieved, and the pressure increased to 1.2 inches. At 6:30 P.M. the superintendent, knowing that workshops and stores had ceased to draw from the supply, opened two gasholders which had been kept in reserve, and the pressure at once went up to 2.5 inches, and continued at about the usual rate during the night. This reserve might have been turned on earlier, but the superintendent thought that if the pressure was to be drawn down to zero, and in consequence that lights should go out all over the city at once, it would be better that it should occur in the afternoon when no personal harm would be likely to follow.

Such an occurrence in the evening, when theaters and other public resorts are crowded, would be almost sure to result in a panic, with injury to many. On the most recent day of 24 hours, when there was clear sunlight throughout the daytime, the consumption of the company's gas was 1,316,000 cubic feet. Had the same conditions prevailed Tuesday the figure would have been about the same, but the actual consumption on that day was 2,735,000 feet. While this is not greatly in excess of the amount used in a day which is very dark throughout, it is shown by the register that the million extra feet was mostly used between noon and 5 P.M., though this does not represent the full discrepancy. Owing to an unusual drain of gas during the few preceding days, the forcing process was resorted to to keep up the reserve. In this process a large amount of cannel and Albert coal was used, which produced a gas of thirty candle quality, while the ordinary production is but nineteen candle. Had this grade of nineteen candle gas been the only product available on Tuesday, the superintendent estimates that the consumption would have been nearly 2,800,000 cubic feet.

Vincennes Gas Light Company.

The Citizens Gas Light Company held their Annual Meeting September 5th, at which H. A. Foulks was re-elected President, and Geo. G. Ramsdell Supt., Secy., and Treas.

During the year this company have laid 7,960 feet of new mains, adding 52 new street lamps. They are now constructing a new gasholder of 40,000 capacity.

THE AMERICAN
GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

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Manager—C. E. SANDERSON.

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FRIDAY, SEPTEMBER 16, 1881.

Gas Stocks.

Quotations by G. W. Close Jr., Broker and Dealer in Gas Stocks.
(with W B Scott & Co.,)
34 PINE STREET, NEW YORK CITY.

SEPTEMBER 16, 1881.

☞ All communciations will receive particular attention
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid.	Asked
Gas Co.'s of N. Y. City.				
Central	$166,000	50	60	65
Harlem	1,800,000	50	89	90
" Bonds	170,000			103
Manhattan	4,000,000	50	210	215
Metropolitan	2,500,000	100	150	152x
" Scrip	1,000,000	..	105	109
Mutual	5,000,000	100	69	70
" Bonds, go'd.	900,000	1000	100	104
Municipal	1,500,000	100	185	190
" Bonds	750,000		106	110
New York	4,000,000	100	105	106
Northern	270,000	50	—	100
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	125	127
Citizens	1,200,000	20	53	56
" S. F. Bonds.	320,000	1000	100	105
Fulton Municipal	1,500,000	100	70	75
Peoples	1,000,000	10	35	40
" Bonds	290,000	.	101	104
" "	250,000	...	70	75
Metropolitan	1,000,000	100	60	65
Nassau	1,000,000	25	62	64
" Ctfs.	700,000	1000	95	100
Williamsburgh	1,000,000	50	63	67
" Bonds		...	98	103
" Bonds	40,000	—	—	—
Richmond Co., S. I.	300,000	...	70	75
Out of Town Gas Companies.				
Buffalo Mutual, N.Y	750,000	100	72	76
" Bonds	200,000	1000	95	100
Citizens, Newark	918,000	50	85	90
" " Bds.	124,000	—	105	10
Chicago Gas Co., Ills			125	—
Cincinnati G. & C. Co.			178	180
Consolidated, Balt.			56	57
Bonds			107	—
East Boston, Mass		25	114	120
Hannibal, Mo	100,000	100	95	100
Hartford, Conn	700,000	25	140	144
Halifax N. S.	400,000	40	148	150
Hamilton, Ontario	155,000	40	117½	
Jersey City	750,000	20	155	160
Jacksonville, Ill	120,000	50	100	...
Lewistown Maine	400,000	100	—	100
Laclede St Louis Mo	1,200,000	100	108	110
Montreal, Canada	2,000,000	100	153	154
New Haven, Conn		25	132	—
Oakland, Cal			32	33
Peoples, Jersey City		...	95	100
" " Bds.				5
Pittsfield, Mass			120	130
Rochester, N. Y.		50	70	80
" Citizens		100	30	35
Woonsocket, R. I.	150,000	100	80	...
Wilmington, Del.		50	174	...
Yonkers		50	30	32
Rondout & Kingston			75	80
St. Louis Missouri	600,000	50	250	254
San Francisco Gas-Co., S. Fr'isco Cal.			68	69
Toledo, Ohio			95	97
Troy, Citizens	600,000	100	—	—
Washington, D. C.	1,500,000	20	213	215
" Scrip	375,000	20	230	233

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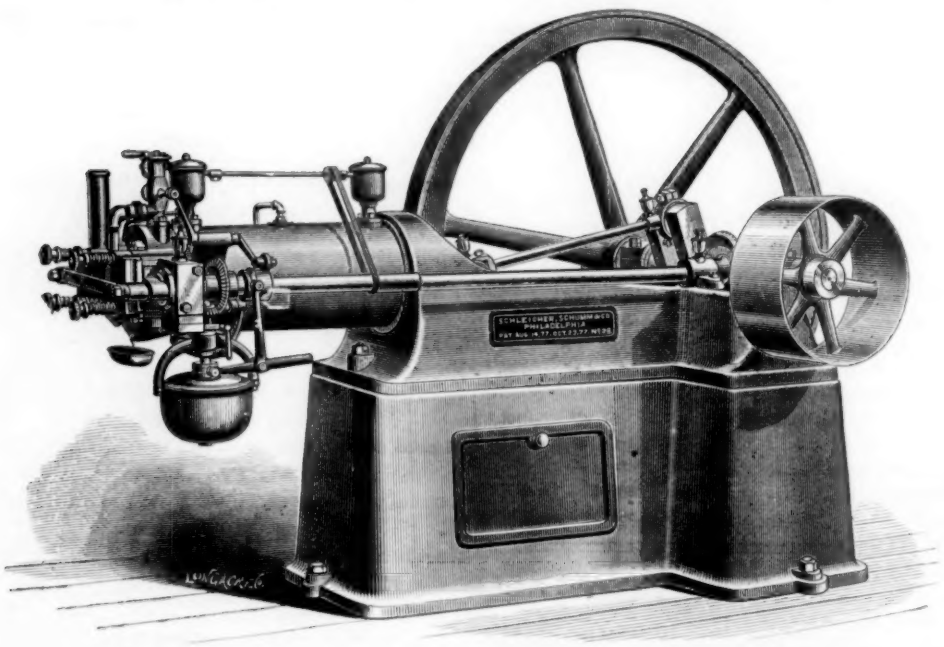

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Gas Light Companies are cordially invited to visit Yonkers and inspect this new system, which, if electricity *should* eventually drive them out of the field of illumination, will open to them another field still more vast and fruitful, and from which they never can be dispossessed. The Westchester Gas Light Company of the city of Yonkers employes the Lowe Process for making its gas. Here, then, can be seen, side by side in business competition, the Strong and the Lowe against the Motay and the old coal gas methods, and each observer will be enabled to form his own opinion as to their relative power and value. The STRONG GAS FUEL AND LIGHT COMPANY is the proprietor for the State of New York of the Strong Patents, five in number, and of the Lowe Patents, two in number. All applications for licenses or for information should be addressed, as above, to

R. W. VAN PELT, *President of the Company,*
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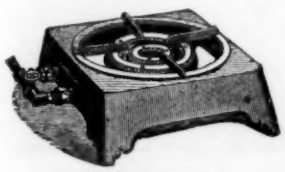

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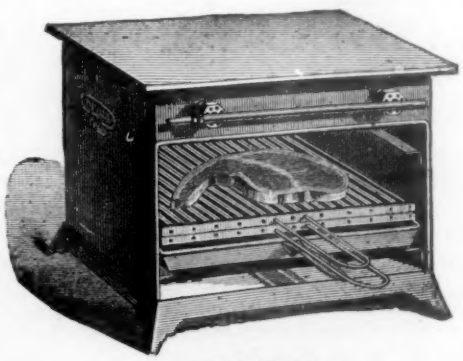

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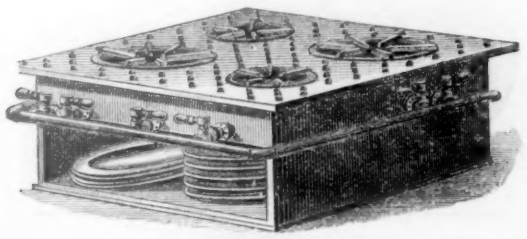

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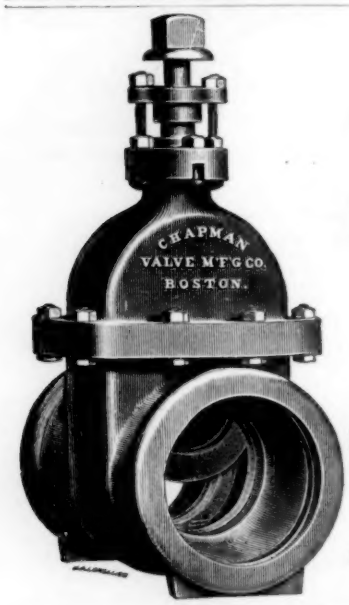

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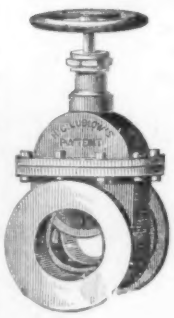

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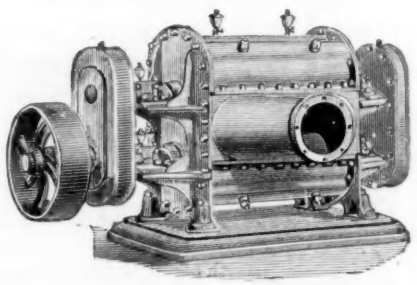

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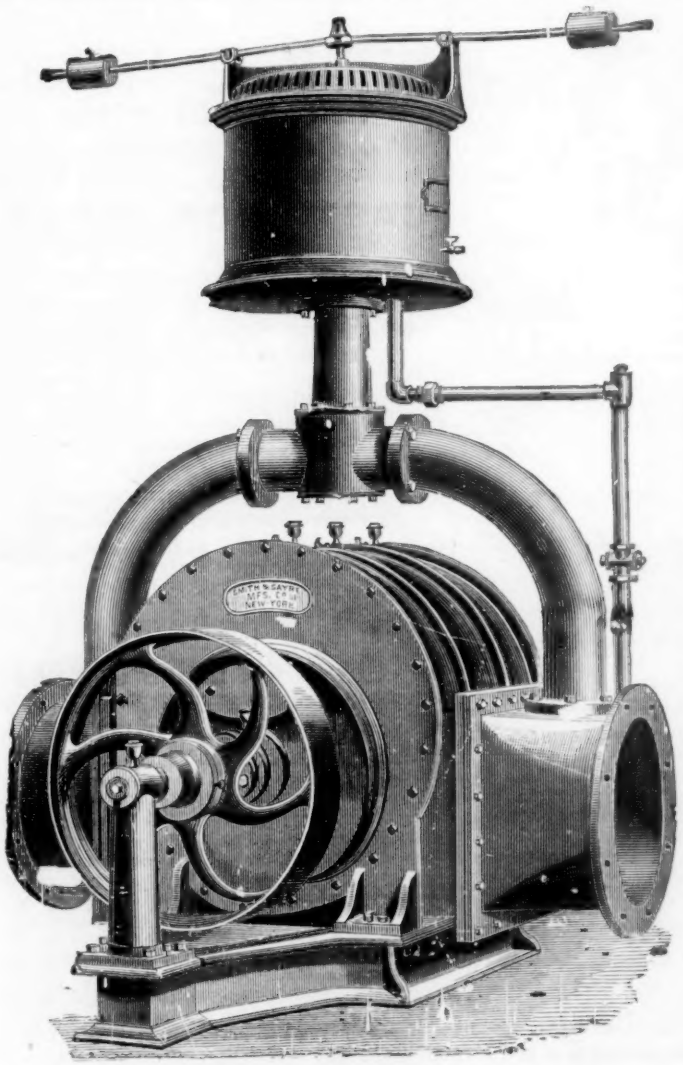

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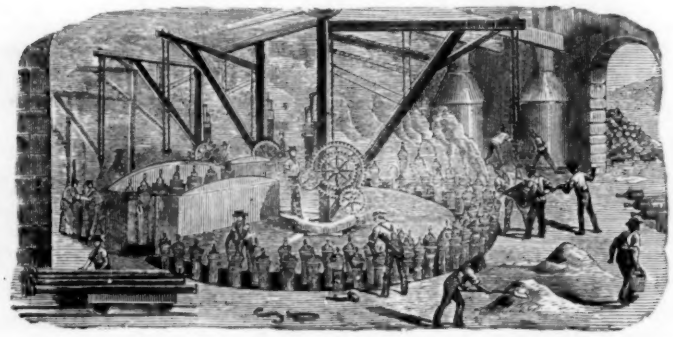

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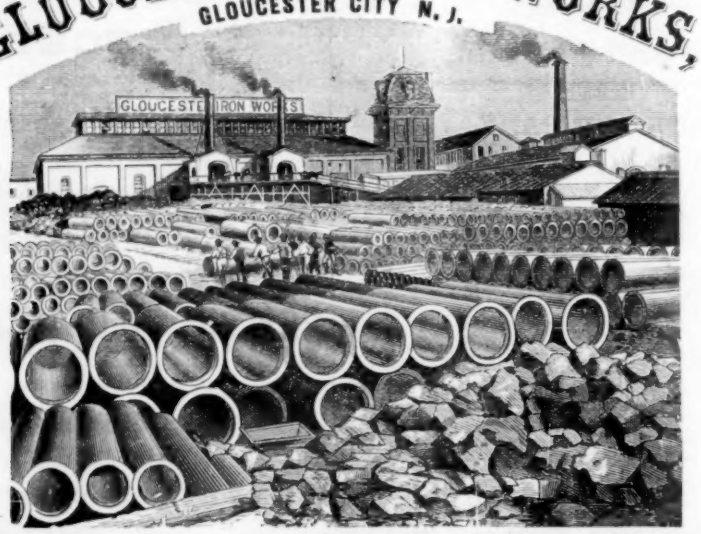

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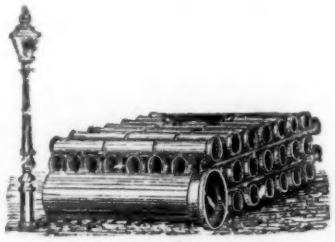

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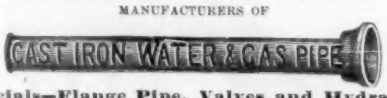

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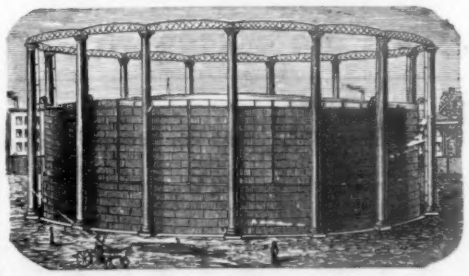

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Mines at Newburg, Preston County, W. Va.
Company's Office, No. 52 S. Gay Street, Baltimore, Md.
C. OLIVER O'DONNELL, Pres't. CHAS. MACKALL, Sec'y.
CHAS. W. HAYS, Agent in New York, Room 7, Trinity Building, 111 Broadway.

This Company offer their very superior Gas Coal at lowest market prices.

It yields 10,996 cubic feet of gas to the ton of 2,240 lbs. of good illuminating power, and of remarkable purity; one bushel of lime purifying 6,792 cubic feet, with a large amount of coke of good quality.

It has been for many years very extensively used by various Gas Companies in the United States, and we beg to refer to the Manhattan, Metropolitan, and New York Gas Light Companies of New York; the Brooklyn and Citizen's Gas Light Companies of Brooklyn, N. Y.; the Baltimore Gas Light Company of Baltimore, Md., and the Providence Gas Light Company, Providence, R. I.

Best dry coals shipped from Locust Point, wharves, and prompt attention given to orders for chartering of vessels.

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DESPARD COAL

To Gas Light Companies throughout the country.

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BANGS & HORTON, No. 31 Duane street, Boston.
Mines in Harrison County, West Virginia.
Wharves Locust Point, Company's Office, 15 German St., } Baltimore.

Among the consumers of Despard Coal, we name: Manhattan Gas Light Company, New York; Metropolitan Gas Light Company, New York; Jersey City Gas Light Company, N. J.; Washington Gas Light Company; Portland Gas Light Company, Maine

"*" Reference to them is requested. 204-

THE

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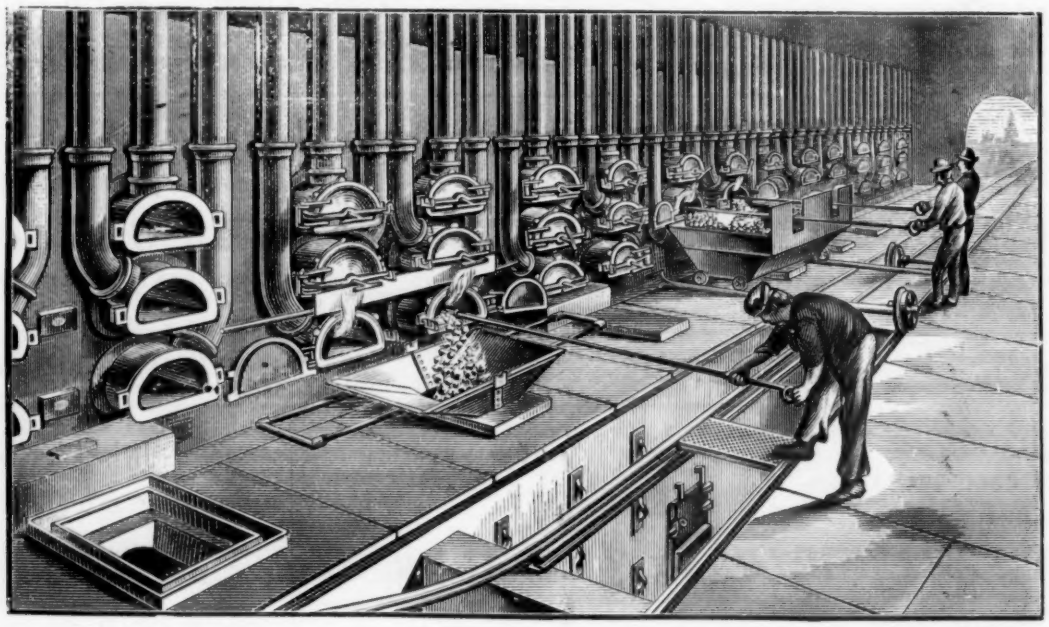

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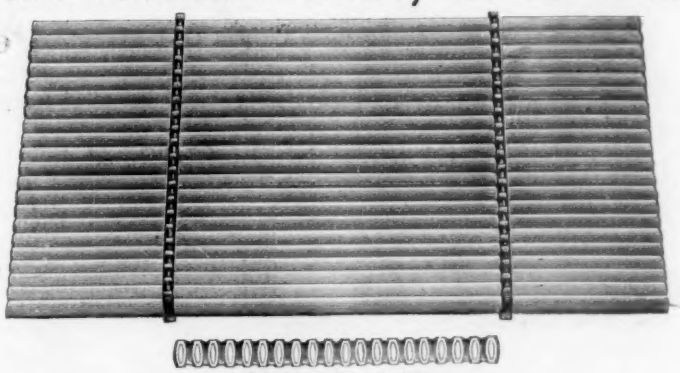

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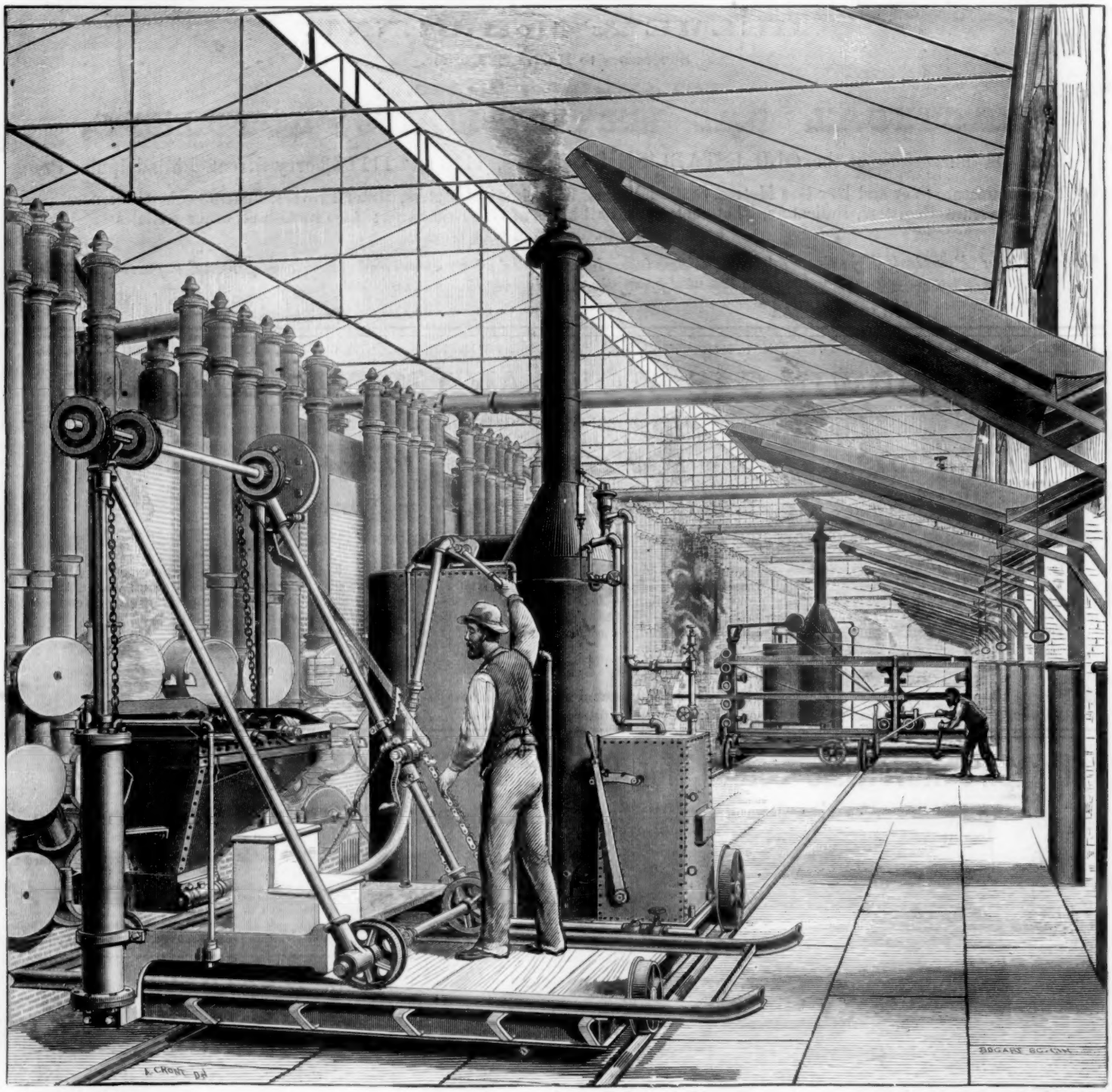

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